ARCHIVES OF OPHTHALMOLOGY.

TRAUMATIC PARALYSIS OF THE ABDUCENS NERVE.

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I.—ORBITAL AND PERIPHERAL PARALYSIS OF THE ABDUCENS NERVE.

PARALYSIS may be caused by direct division of the external rectus muscle or of its tendon. Cases are probably more frequent than the number of those published would indicate. Berlin [1] collected but twelve cases of direct injury of an ocular muscle, but this number has increased considerably (Aschmann, Guttmann, de Britto, Mengin, and others). In Berlin's list there were six cases where the internal rectus was affected; in four, the inferior rectus; in two the levator (once with the superior); the external rectus and the two oblique muscles were each affected but once. The case he cites in which the external rectus was involved is one of Beer's [2]:

There was severe injury by a pipe-stem, part of which entered the lateral side of the orbit, producing anterior dislocation of the eyeball. With the extraction of the foreign body, the dislocation disappeared, but complete paralysis of the external rectus muscle remained. It subsequently recovered its function in part.

We have found another case of this kind cited by von Oettingen.[3] The results as to degree and the spontaneous

[1] "Verletzungen der Orbita," *Graefe-Saemisch*, vol. vi., 2.
[2] *Lehre von den Augenkrankheiten*, vol. i., p. 146.
[3] *Die indirecten Laesionen des Auges bei Schussverletzungen der Orbitalgegend*, p. 38. Stuttgart, 1879.

disappearance of the paralysis vary, according as there is complete or partial division of the muscle. That spontaneous recovery may occur in a partial laceration was shown in the case of von Graefe, in which there was incomplete division of the internal rectus muscle (cited by Berlin). The diagnosis of complete laceration, as Berlin has pointed out, is based upon permanent loss of motion. When the muscle is partially torn, the disturbance of motion does not differ in its symptoms from that which is caused by orbital hemorrhage. Other causes beside laceration of the muscular tissue may mechanically interfere with the function of the muscle; such are: hemorrhage in and around the muscle, inflammatory processes, etc.

Tearing of the orbital portion of the abducens nerve seems to occur more rarely than that of the muscle itself. We could not find a case of this kind excepting the one of Berlin.[1]

A shot pierced the sclera near the inner side of the cornea, passing directly back and making its exit in the posterior part of the eyeball. Its path could be traced with a probe to the deepest part of the external wall of the orbit. There was destruction of sight, orbital hemorrhage, and slight temporary limitation of the ocular movements in all directions. but absolute and permanent immobility outwards.

Contusion of the nerve " by comminuted fracture at the apex of the orbit " (Mauthner) may also produce paralysis of the abducens, but scarcely an isolated disturbance of this muscle. An extravasation of blood or an inflammation in its orbital course may likewise impair its function. And finally we must mention pulsating exophthalmus of traumatic origin, which may be accompanied by paresis of an eye-muscle, especially of the abducens. Paresis and paralysis of traumatic pulsating exophthalmus, according to Sattler, are not, by any means, to be always regarded as orbital; they are rather to be attributed to injury of the nerve in its course through the cavernous sinus, caused

[1] *Loc. cit.*, p. 640.

either directly by the traumatic lesion (tearing) or as a subsequent result of the trauma.

We have thus transgressed our limit, having touched upon a part of the intracranial traumatic paralyses, and shall therefore omit any mention of this variety below. The cases of traumatic pulsating exophthalmus in which paralysis of the abducens is specially mentioned, are those of: Legouest, Gruening, Rothmund-Schalkhauser, Nieden, Hjort, Coe, Secondi, von Hoffmann, Lubrecht, Lloyd, Eales, Glascott, and finally, the recent one of Eckerlein.[1]

II.—INTRACRANIAL TRAUMATIC PARALYSIS OF THE ABDUCENS NERVE.

A.—*Unilateral Paralysis.*

CASE 1, of Robert,[2]

A man, aged forty, fell a distance of twelve metres upon his feet. At first there were only slight symptoms of cerebral concussion. In three weeks paralysis of the abducens was noted. Four months later he became delirious, and died. The post-mortem examination showed that both clinoid processes had been separated from the sphenoid bone. There was a transverse fracture through the upper third of the right temporal bone with separation of a large fragment. The nerve was torn at the level of this fracture.

Robert's case is classical, for it gives the anatomical explanation of the paralysis. It is very remarkable that division of the nerve may occur from fracture without any other severe symptoms, such as coma, paralysis of other cranial nerves, or the usual symptoms of fracture of the base of the skull. The paralysis of the abducens was evidently recognized late, as it must have occurred at the time of the injury.

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[1] In Eckerlein's case of bilateral, pulsating exophthalmus, all the paralyzed muscles regained their function, excepting both external recti muscles, which remained permanently paralyzed.

[2] See *Pitha-Billroth*, vol. iii., 1st ed., p. 235.

CASE 2.

A second case of primary paralysis in which a post-mortem examination was made, was reported by Jacobi.[1]

A man was injured by a piece of timber falling upon the right side of his head. He was unconscious for a time, and had bleeding from the mouth, nose, and left ear. He improved, could walk about, but had a slight rise of temperature, a very rapid pulse, and unquenchable thirst. There was paralysis of the right abducens and almost complete blindness of the left eye (due to hemorrhagic retinitis). Patient died on the eighteenth day. The post-mortem examination revealed extensive fractures of the skull, extending down to the sella turcica on both sides, and hemorrhagic clots, one of which was lying in the region of the left cavernous sinus. The immediate cause of the paralysis of the abducens could not be found, but the course of the fracture and the coagulum in the left cavernous sinus showed that tearing or compression of the nerve may have occurred.

A basal lesion is likewise probable in this case. The *completeness* of the paralysis, as well as the extensive basal lesions, inclines us to this view; still it is not impossible that the paralysis may have been nuclear. We may consider this a case of isolated paralysis of the abducens, which, as in Robert's case, persisted for some time, while the patient was in relatively good health,—death finally taking place secondarily.

CASE 3, reported by Armaignac,[2]

is the only one in which paralysis of the trochlear nerve also occurred. A man was thrown from his horse and dragged hanging in one stirrup for a distance of four hundred to five hundred *m*. He bled from the mouth, nose, and left ear, and the left eye was greatly swollen. On recovering consciousness at the end of almost a month, his left eye was found to be nearly blind and was perfectly immovable, being highly adducted. Vision gradually returned, and with it diplopia made its appearance. Be-

[1] "Casuistische Beitraege." *Graefe's Archiv fuer Ophthalm.*, vol. xiv., 1, pp. 147–149.

[2] "Paralysie complète du muscle droit externe et du muscle grand oblique de l'œil gauche avec strabisme convergent," etc. *Rev. clin. d'ocul.*, 1884, No. 5.

sides the ocular trouble there was deafness of the left ear and tinnitus aurium. Dr. Moure diagnosed fracture of the petrous portion of the temporal bone. Four years later, Armaignac found complete paralysis of the left external rectus and superior oblique, besides the lesion of the left ear He was unable to decide upon the cause of the transitory blindness, but ascribed the above paralyses to a lesion of the nerves near the fracture of the temporal bone.

This view is undoubtedly correct.

Cases 4, 5, 6, and 7 are reported by Nieden.

CASE 4.[1]

A man aged twenty-eight received a series of very severe head injuries by being thrown down a long chute. He was somnolent, and there was bleeding from the mouth, nose, and ears. Complete paralysis of the right external rectus was noted on the following morning. The other symptoms were polyuria and polydipsia, amaurosis of the left eye, and temporal hemianopsia of the right, deafness of the right, and diminution of hearing of the left ear. Atrophy of the left optic nerve, and of the inner upper quadrant of the right optic disc, soon made their appearance. The visual impairment persisted, but the paralysis of the abducens disappeared entirely.

Nieden believed that a lesion of the chiasm was the cause of the disturbed vision. He attributed the paralysis of the abducens to fracture of the base; an isolated extravasation near the nucleus of the right abducens might also be accepted as the cause, inasmuch as there was diabetes insipidus. Simple compression of the origin of the nerve or of the nucleus in the floor of the fourth ventricle, is improbable, since the facial and trigeminal were unaffected. For our part we do not hesitate to accept the latter view both in this and in the following case.

CASE 5[2]

is similar to the foregoing. Unconsciousness lasted several

[1] "Zur Casuistik der nach traumatischen Verletzungen des Hirnes und Rückenmarkes auftretenden Augenstörungen." *Arch. f. Augenheilk.*, vol. xii., p. 30.

[2] *Ibid.*, p. 39.

days ; there was amaurosis of the right eye, paralysis of the left abducens, and deafness of the left ear. There was also visual impairment of the left eye, as in Case 4, but central vision was much affected, and the temporal half of the field division but little. Diabetes insipidus appears likewise to have occurred in this case. There is no further mention of paralysis of the external rectus.

CASE 6[1]

was due to a stab wound piercing the squamous portion of the left temporal bone. Consciousness returned in three weeks. At first there was motor paralysis of the right half of the body, sensory aphasia, and, finally, persisting paralysis of the left abducens.

The first two symptoms depended, according to Nieden, upon direct injury of the brain. As the abducens or the pons were not directly injured, we are led to infer that this may have been due to injury of a possible cortical centre of the abducens. It is important to learn that a *high degree of convergence of the left eye manifested itself as early as the fourth day*, and persisted. An advancement of the paralyzed muscle and tenotomy of the internal rectus were performed later. Neuroparalytic keratitis developed subsequent to this operation. It was then that paralysis of the left trigeminus was noted. This was likewise attributed to a central and not a basal lesion.

CASE 7.[2]

Fracture of the base from severe injury of the occiput while the patient was lying with his face down. Age of patient, twenty-six years. Unconsciousness lasted three days. When the eyes were opened, a high degree of convergence of the left eye was observed ; this persisted. There was, besides, paralysis of the left trigeminal and facial and of the right acoustic nerves.

These were attributed to direct injury of the nerves by the basal fracture.

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[1] *Ibid.*, p. 40, and also vol. xiii., p. 251.
[2] *Arch. f. Augenheilk.*, vol. xiii., p. 259.

CASE 8.—Nieden also makes mention of a case of Snellen, in which a head injury was followed by paralysis of the trigeminal and later of the abducens. He also cites another,

CASE 9, of Haase.[1]

A workman, aged twenty-eight, fell with great force from a wagon. He was not unconscious, but could not open his mouth. For three days there was a bloody discharge from his right ear. Paralysis of both legs and of the left arm followed. Externally there were only small wounds of the right ear and of the temporo-occipital region, which rapidly healed. After eleven weeks there was still weakness of the left arm (which subsequently disappeared), besides anæsthesia of the left eye (?), a dull feeling of the right side of the face and of the mouth, and right convergent strabismus, from paralysis of the abducens. An advancement performed three years later diminished the strabismus, but at this time there was still right facial paralysis. Ten years later, neuroparalytic keratitis appeared.

This was evidently a case of fracture of the base of the skull, with persisting paralysis of the abducens and trigeminus, and paresis of the facial nerves. The author endeavored to explain the late occurrence of the neuoroparalytic keratitis, by the assumption that the sensory and not the trophic nerve fibres were paralyzed (" by the hemorrhagic extravasation "), but Nieden has shown that this view is untenable. A hemorrhage may have taken place in the region of the nuclei, but a basal lesion is much more probable. The paralysis of the extremities was probably indirect and due to an extravasation at the base.

CASE 10, of Casper,[2] is as follows:

A man was found lying unconscious on the road. He subsequently said that he had been struck on the head, whereupon he had fallen unconscious. There was a deep wound over the left malar bone, extending over the frontal and parietal bones to the

[1] *Graefe's Arch.*, vol. xxvii., 1, p. 268.
[2] Casper's *Prakt. Handbuch der gerichtlichen Medizin*, ed. by Liman, 1871, vol. i., p. 317.

occiput ; a second wound lay near to the ear, and a third severed the left ear in its upper third from the head. In thirteen weeks the wounds had healed, but "the right eye was adducted to such a degree that the pupil was almost in the inner canthus, and the patient was unable to draw the eye outward. The eye was inflamed and reddened. There was a small flattened opacity of the cornea covering the pupil. Besides this there was paralysis of the nose, mouth, and of the left extremities, and there was partial deafness of the right ear."

In this case we have paralysis of the right abducens with left hemiplegia, following an injury of the head, and besides a probable paralysis of the right facial, acoustic, and trigeminal nerves, though the paralysis of the last mentioned cannot be positively asserted; the cornea may have suffered an injury at the time of the accident. It is impossible in this case to say with certainty where the lesion was, for the account is not sufficiently detailed ; the assumption of a hemorrhagic lesion in the right half of the pons is justified by the fact that the hemiplegia disappeared only to a moderate extent, and that no mention is made of bleeding from the ear. Still we cannot dispute the possibility of an accompanying fracture of the base with direct involvement of the nerves. The former view is supported by an interesting case of Romberg's,[1]—a case of pontine hemorrhage which enlarged the right half of the pons to more than double its size, but pressed the left half of the pons and of the medulla out of position and form; the right abducens, trigeminus, facial, and acoustic were most affected.

CASE II, of Diberder.[2]

An injury to the head was followed by a long-continued bleeding from the ear, unconsciousness, and sensitiveness of the mastoid process. Paralysis of the abducens was the only persistent symptom, and was probably due to direct lesion of the nerve by the basal fracture.

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[1] Casper's *Wochenschrift*, 1842, No. 1.
[2] *Pitha-Billroth*, vol. iii., 1, A., p. 235.

CASE 12.—Aran[1] cites the following:

Resulting from two penetrating bullet wounds of the head, there was paralysis of the right abducens, facial and acoustic. Post-mortem: The temporal bone was found shattered and an abscess was discovered around the bullet in the right hemisphere; there was also softening and injection of the sixth nerve and the Gasserian ganglion.

The softening of the abducens cannot be looked upon as the only cause of the paralysis, when we consider the shattering of the temporal bone.

CASE 13, of Wagner.[2]

A man, aged forty-one, suffered a fracture of the base of the skull. He was unconscious for a few moments, paralysis of the abducens and facial was noted; the uvula did not deviate. During the course of the same day it was found that his hearing in both ears was almost abolished. There were two wounds about the left ear—one horizontal, through the auditory canal, the other vertical, separating the ear from the skull in three flaps. There was a fissure in the temporal bone, running obliquely through the squamous portion and extending into the auditory canal, from which blood trickles. The fissure was cleaned with a chisel; the auditory canal was disinfected and filled with iodoform gauze; the wounds were sutured and drained. In five weeks the condition was as follows: The paralysis of the abducens persisted; the facial paralysis had improved, so that the patient could whistle, but he could not knit his brow or close the left eyelids perfectly. The hearing of the left ear was abolished; that of the right improved, but still very imperfect. The wounds healed without reaction.

The most probable explanation of the paralysis in this case is direct injury of the nerves at the seat of the fracture.

The two following cases are reported by Santos Fernandez[3]:

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[1] *Ibid.*

[2] Die Behandlung der complic. Schaedelfracturen von W. Wagner. Volkmann's *Klin. Vortraege*, Nos. 271 and 272.

[3] Paralysis del 4. y 6 par, por traumatismo cerebral. *Crónica Méd. quir. de la Habana*, No. 8. Cited in *Virchow-Hirsch*, 1880, ii., 2, p. 468.

CASE 14.

A man fell from the height of fifteen feet and suffered a fracture of the left clavicle and a contusion of the left side of the head. He was unconscious for several hours. On the following day his vision was diminished, there was convergent strabismus of the left eye, and weakness of memory. His previous stuttering was increased. There was an old atrophy of both optic discs and paralysis of the sixth nerve.

CASE 15.

A man aged twenty-three was injured in a railroad accident. The train plunged into a river; he was struck on the right side of the head, but he recovered his consciousness through contact with the cold water, and creeping through a window saved himself by swimming. There was bleeding from the nose and from the right ear, impairment of hearing, and diplopia. There was convergent strabismus from paralysis of the right abducens.

In both these cases the paralysis of the abducens was on the side corresponding with the injury. In the second, there was clearly a fracture of the base, which was the direct cause of the injury to the abducens. As to the first case we can only form conjectures, as nothing is mentioned concerning the result. The same is true of the following case:

CASE 16, of Curschmann.[1]

"Unilateral paralysis of the abducens, with amaurosis, hemianæsthesia, and slight hemiplegia of the same side, with deafness of the left ear, following a fall."

CASE 17, of Ferri.[2]

Paralysis of the right abducens, with incipient atrophy of the right optic disc, followed a fracture of the base. This was probably a direct injury, the atrophy indicating probable fracture of the optic canal.

CASE 18, of Critchett and Juler.[3]

A boy aged fourteen was injured about the head; four days

[1] *Virchow-Hirsch*, 1877, ii., 1, p. 115.
[2] *Virchow-Hirsch*, 1883, xviii., ii,. 2, p. 475.
[3] *Centrabl. f. prakt. Augenheilk.*, 1884, Aug., p. 245.

later convergent strabismus and diplopia made their appearance. The strabismus persisted. Primary and secondary deviation were equal. There was slight restriction of motion of the right external rectus, and a hypermetropia of 5 D. The strabismus was therefore looked upon as concomitant, but Nettleship pointed out that the diplopia indicated that strabismus had not previously existed.

Perhaps there was a hemorrhage which may have had its seat in the nuclear region. The late appearance of the strabismus does not prove that paralysis did not occur immediately; however, we may regard a circumscribed reactive inflammation at the base as still more probable.

A nuclear hemorrhage, on the other hand, seems to be the better explanation in the following cases of Wahl, Hirschberg, Mooren, Panas, and Steinheim.

CASE 19, of Wahl.[1] (Also cited by Bergmann, see *Pitha and Billroth*, vol. ii., 1 A, p. 235.)

An artilleryman was injured on the right side of the face and temple by an exploding shell, and immediately became deaf. He subsequently complained of continuous giddiness and a dull headache on the right side. At an examination a few days after the injury, it was found that the right ear was deaf, though the drumhead was uninjured. Vertigo and headache were intense, and he was further annoyed by binocular diplopia. The right eye was turned somewhat toward the inner side and could not be moved outward beyond the median line. Within two months, during which period he was under treatment, he greatly improved, the diplopia had disappeared, and the disturbance of the acoustic nerve was very slight.

CASE 20, Hirschberg.[2]

A boy aged fourteen, who had fallen upon the occiput, appeared two days later complaining of strabismus and diplopia. Vision was normal, as were likewise the retina and optic discs of both eyes. There was paralysis of the left abducens of high degree. In about four months the diplopia had entirely disappeared.

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[1] *Arch. f. klin. Chirurgie*, xiv., p. 32.
[2] *Breitraege z. prakt. Augenheilk.*, ii., Leipzig, 1877.

CASE 21, Mooren.[1]

In a case of paralysis of the right abducens, resulting from slight concussion of the brain, from a fall, the diplopia disappeared entirely upon application of ice to the head, and perfect rest. There was also transient paralysis of the accommodation, but no injury to the optic nerves.

CASES 22 and 23, Panas.[2]

The first was a child, aged twelve; the second, a man, aged thirty-eight. Both suffered severe injuries. After the first week a slight degree of convergent strabismus appeared in both, though there had been no symptoms of coma or fever. The paralysis corresponded with the side of the injury. Both recovered.

CASE 24, Steinheim.[3]

There was nuclear paralysis of the abducens following an injury from a stone thrown against the occiput. The case was complicated with diabetes insipidus. The cause was probably a hemorrhage at the floor of the fourth ventricle; both symptoms disappeared.

CASE 25, H. Hadlow.[4]

There was bleeding and a flow of cerebro-spinal fluid from the ears for three days after the injury; there was likewise paralysis of the abducens. Complete cure resulted in a few months.

CASE 26, Kroenlein.[5]

A dyer, age forty, was found in an unconscious condition. He could not be roused but moved slightly when loudly spoken to. Pricking the skin of the extremities caused them to make slight movements, those of the left leg being most imperfect. Facial paralysis could not be made out definitely. There appeared to be paralysis of the left abducens and left-sided nystagmus. The

[1] *Ophthalm. Mittheilungen*, Berlin, 1874, p. 111.
[2] "Paralysie du nerf moteur externe consécutive aux traumatismes du crâne," *Arch. d'Opht.*, i., p. 3.
[3] "Nucleare Laehmung des Abducens und Polyurie," *Deutsche med. Wochenschr.*, 1885, No. 30.
[4] Fracture of the base of the skull. Paralysis of the abducens. Recovery. *Lancet*, Aug., *Virchow-Hirsch*, 1877, ii., p. 406.
[5] *Deutsch. Zeitsch. f. Chirurg.*, von Luecke and Rose, vol. xxiii., p. 220, Case 4.

skin behind the right ear was doughy, and firm pressure upon it appeared to give pain. There was also retention of urine. Ten days afterward the analgesia of the whole body had increased; the right extremities alone responding to irritation. There was no facial paralysis. A supradural hæmatoma (from the right middle miningeal artery) was diagnosed, but trephining gave a negative result. Death occurred in a few days. At the post-mortem examination a thick clot of blood was found lying over the right occipital lobe upon the dura. There was a fissure through the petrous portion of the right temporal bone and the right parietal bone, running toward the occipital protuberance. Besides this there were numerous small round extravasations of blood in the substance of the brain, especially in the anterior central convolution, the third frontal convolution, and the first temporal convolution of the right side.

The absence of any notes concerning the abducens prevents us from deciding upon the seat and the nature of the injury of this nerve. It is, however, remarkable that there was *left-sided* paralysis of the abducens and nystagmus, when we consider the results of the post-mortem examination. Perhaps there was a hemorrhage in the left nucleus which escaped observation.

The unilateral nystagmus is of special interest. It has been noted, according to Graefe,[1] after injury of the skull by Nagel and Cohn; by the former after a fall on the right side of the forehead producing fracture, and by the latter after a gunshot injury of the left temporal bone. One-sided nystagmus is, however, exceedingly rare.

The following case, which is of special interest, was kindly furnished me by my colleague, Dr. Th. Sachs, of the University of Innsbruck:

CASE 27.

Josef M., age nineteen, was struck on the 29th of April, 1887, at 9 P.M., upon the head with a thick board (2 *m* long, 8 *cm* broad, and ¾ *cm* thick). The exact point of injury could not be ascertained. He fell upon the floor and remained unconscious till midnight. During this time he had convulsions and both eyes

[1] *Graefe and Saemisch*, vol. vi., p. 237.

were turned toward the right. During the same night he was taken to the surgical clinic where he soon recovered his consciousness. Dr. Rainer found no depression or fracture of the skull; the movements of the eyes were normal and the diagnosis was concussion of the brain. On April 30th he left the hospital and was treated by Dr. Koelner, who discovered symptoms of cerebral pressure—benumbed consciousness, headache, vomiting, slowing of the pulse; the temperature was normal.

Dr. Sachs was called upon on May 2d to make an ophthalmic examination; at this time there was a small area of sensitiveness to percussion at the junction of the temporal and parietal bones, on the left side. Furthermore there was paresis of the branches of the right facial nerve supplying the cheek and mouth. The tongue when extended pointed to the right. There was considerable difficulty in speech. Consciousness and intelligence were not affected in any marked degree. The pulse was 40 ! ! The temperature was normal. An ophthalmoscopic examination and a careful examination of the ocular movements revealed no abnormalities. The pupils were equal in size. On the 3d of May, Dr. Sachs noted convergent strabismus of the *right* eye, due to slight paresis of the *left* external rectus, the left eye being used for fixation. There was distressing diplopia. On May 4th, the paralysis had increased greatly and the left eye was no longer used for fixation. On the 5th of May, the paralysis was complete, and there was secondary contraction of the internal rectus, giving rise to paralytic strabismus. There was homonymous diplopia in all parts of the field of fixation. During the following days, his general condition improved greatly. The headache disappeared, the pulse became more rapid, the difficulty in his speech became less apparent, but there was no change in the condition of his eyes. On May 12th the deviation of the left eye, as measured with the perimeter, is 11°. The secondary deviation of the right eye, produced by covering it and forcing the left eye to fixate, is about 25°. The left eye could be moved very slightly beyond the median line. There was homonymous diplopia in all parts of the field of fixation, increasing toward the left, but the two images were always of equal height. The vision, accommodation, and fields of vision were perfectly normal. Iodide of potassium (1.0 g. daily) was ordered. May 16th, there was evident increase of the movements of the left eye outward. May 18th the improvement continued. The antagonistic contraction

of the internal rectus had decreased. Galvanization. On June 1st, the antagonistic contraction of the internal rectus had entirely disappeared. The left eye could be abducted to such an extent that the cornea was not more than 1 *mm* distant from the outer canthus, and at times even reached this point. There was no diplopia in the median line within a distance of 6 *m*. Toward the left there was still slight diplopia, but not sufficiently disturbing to prevent the patient from resuming his occupation.

This case appears to me to be remarkable because the paralysis of the abducens did not appear immediately after the injury, thus excluding direct injury of the nerve trunk. There were no signs of fracture of the base, such as paralysis of other cranial nerves, hemorrhage from the ear and nose, etc. It appears to me to be impossible to attribute the paralysis which gradually developed three days after the injury, to meningitis, for there was no fever at any time, there was no disturbance of consciousness, and because it terminated in recovery. We (Sachs) "consider it probable that there was in the first place an intermeningeal extravasation at the seat of the injury, at the junction of the temporal and parietal bones (the pressure exerted being perhaps the cause of the transitory disturbance of speech). Within a few days after the injury the exudation may have moved downwards and thus caused pressure of the abducens. The late appearance and the recovery would thus find an explanation."

We have nothing to add to Sachs's statement concerning the cause of the paralysis. This is the only case of single, secondary paralysis of the abducens, besides the case of Snellen, that we have been able to find. The primary conjugate deviation of the eyes to the right had no connection with the paralysis, but probably depended, as did the convulsions, upon a cortical disturbance.

The two following cases are much less definite, the question of a primary or a secondary nature of the paralysis, being unanswerable.

CASE 28, of Thomson.[1]

[1] Case of fracture of the skull in which conjugate deviation of the eyes, which had existed for four months, was removed by trephining by G. Thomson. *Brain*, 1883, April, p. 99. Reviewed in *Centralbl. f. Augenheilk.*, 1883, p. 246.

A boy, æt. fourteen, suffered a severe injury by having his head caught between the rounded ends of two iron posts and compressed laterally. The result was a fracture of the skull on the left side only. When admitted, there were symptoms of cerebral irritation: fever (107.5° F.), irregular respiration, delirium, etc. Consciousness began to return very gradually from the 21st day. When the eyes were first opened voluntarily (two months after the injury) there was deviation of both eyes toward the right. There was also a feeling of pressure in the supra-orbital and frontal regions, especially on the left side. The conjugate deviation gradually increased to that degree that the pupils were almost entirely hidden in the angle of the palpebral fissures, which prevented the patient from seeing, Five months after the injury the skull was trephined at the seat of the depressed fracture. Two loose fragments of bone were found irritating the brain and were removed. On recovering from the effects of the anæsthetic the patient stated that the feeling of pressure had disappeared; the deviation improved though it was still considerable. Fourteen months after the injury the ocular movements were almost perfect; the left external rectus alone was still paretic. V. R. E. $\frac{20}{20}$. The left pupil was stationary and there was no perception of light. The ophthalmoscopic examination showed white atrophy of the disc; the right disc was slightly pale but otherwise normal.

The optic atrophy was certainly due to direct injury of the nerve, probably in the optic canal. A similar explanation of the paralysis of the abducens, *i. e.*, an injury of the nerve by basal fracture, though not impossible, is much less probable on account of the *persistence of paresis—not paralysis.*

An extravasation or a basal meningitis might also serve as an explanation, and it is possible that the paresis of the left abducens and the conjugate deviation were dependent upon different causes. It appears more reasonable, however, to suppose them to have been due to a single cause, either cortical or nuclear, and the persistence of the paresis likewise points to one or the other of these parts. There is no mention made of deviation of the head, but it would appear that the presence or absence of this sign would not aid us in the diagnosis, for deviation of the head and of the

eyes towards one side has been observed with lesions both at the cortex and at the base.[1] It is well known that in the great majority of cases of conjugate deviation, the lesion was found in the pons, in the region of the nuclei of the abducens. The centre of associated movements is situated, according to Wernicke, in the floor of the fourth ventricle, very near the nucleus of the abducens, there being, in reality two centres; the one on the left governs movements toward the left; the one on the right, those toward the right. Paralysis of the centre governing movements to the left would explain a paralysis of motion to the left, but it would not suffice to account for conjugate deviation to the right. Simple, secondary contraction of the antagonist could not take any part, for then the deviation would have persisted. And such a case has never been published (Wernicke). There must evidently have been simultaneous irritation of the centre governing movement to the right.

The simplest explanation appears to be the assumption of a lesion at the floor of the fourth ventricle, where both centres lie near each other. However, we cannot exclude a cortical lesion. Munk[2] has shown that a lesion of the lower parietal lobule produces restriction of motion of the eyes toward the opposite side. This would apparently argue against our assumption of a cortical lesion. Still we can conceive a serious injury of the cortical centres of the abducens and a slight lesion, not sufficient to produce paralysis, but causing irritation of the centre governing movements to the right. Clinical experience has likewise shown that conjugate deviation may depend upon pathological changes in the cortex of the cerebrum. We can therefore see no decisive reason opposed to the assumption of a cortical lesion as the cause of paralysis of the abducens in Thomson's case, even though the cortical centres of the ocular nerves are as yet very doubtful. As to the persistence of the paralysis of the abducens after the disappearance of the conjugate deviation, we may remark that a similar case, though

[1] Prévost observed seven cases of hemiplegia with conjugate deviation of the eyes and of the head toward the healthy side. In all of them there was softening at the base of the brain. *Canstatt's Jahresb.*, 1865, vol. iii., p. 45.

[2] According to Wernicke, vol. i., p. 272.

not traumatic in its origin, was described by Priestley Smith.[1] Gajkiewicz[2] states that central paralysis of the abducens associated with conjugate deviation of both eyes was first observed by Javille, subsequently described by Féréol and later (1878) was exhaustively discussed by Graux; two cases of the last named author depended upon tubercular neoplasms of the pons.

We may add here a case of Osborne's,[3] in which convergent strabismus may have depended upon an injury of a cortical centre. There was a complicated fracture of the frontal bone, above the right zygomatic process. Strabismus developed after removing a few loose fragments of bone. I make mention of this case because the strabismus evidently appeared immediately after the extraction of the bone, but it is not stated what was the form of the strabismus.

The following case is also doubtful:

CASE 29, of Heyfelder,[4]

was due to a deep penetrating stab wound passing through the sphenoid angle of the right parietal bone. Convergent strabismus of the right eye followed, with diplopia, heaviness in the head, and tinnitus. Death occurred on the 171st day. A purulent canal was found extending from the wound into the left (?)ventricle, beneath which there was a closed abscess containing two ounces of thick yellow pus.

From these statements we cannot determine the nature of the lesion. The nerve trunk may have been injured, or, on the other hand, the lesion may have affected the cortical centres. There are no statements concerning the primary or secondary character of the paralysis.

We shall now cite four fatal cases of secondary paralysis though their traumatic character is somewhat doubtful.

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[1] "A Case of Conjugate Deviation of the Eyes," *Ophth. Hospital Rep.*, vol. viii., 2, p. 185.

[2] "Paralysis centralis v. Nerv. abducens auf einem Auge, combinirt mit der associrten Deviation beider Augen," reviewed in *Centralb. f. prak. Augenheilk.*, 1880, p. 18.

[3] "Fracture of the Skull, Injury to the Third Right Frontal Convolution," *Lancet*; see *Virchow-Hirsch*, 1874, vol. ii., p. 459.

[4] "Beitraege zu der Lehre von den Kopfverletzungen," *Deutsche Klinik*, No. 27; see Canstatt's *Jahresb.*, 1853, vol. iv., p. 48.

CASE 30, of Gelpke.[1]

Left convergent strabismus and ptosis, associated with left hemiplegia, following a trauma. A cerebral abscess was found resulting from the trauma, and there was likewise a purulent deposit over the whole of the right hemisphere and on the base. The paralysis of the abducens and the hemiplegia probably depended on different lesions.

CASE 31, of Kniesling.[2]

A girl aged ten, fell from a height upon her head. Headache and vertigo were not noted. A month later, strabismus of the left eye appeared, and unsteadiness of gait. There was gradual aggravation of the symptoms,—speech became difficult and the right limbs were affected. Two months after the injury there was a high degree of convergent strabismus of the left eye, with diplopia; the pupil was dilated. Finally there was bronchitis, pulmonary paralysis, and death,—but consciousness was preserved to the last. In the left half of the pons at the point where the left crus cerebri makes its exit, there was a globular induration of the size of a small hazel nut.

CASE 32, of Griesinger, cited by Weidler.[3]

A man aged twenty, fell upon his head. Six days later vertigo, pain in the frontal and occipital regions, and vomiting made their appearance. General debility, somnolence, and slowing of the pulse developed subsequently. During the last three weeks his pulse became rapid. Vision was soon and almost completely lost. His gait was reeling, the left extremities became paretic. The pain in the head extended to the neck and the spinal column, and was associated with retraction of the head. There was marked convergent strabismus of the left eye. He had frequent attacks of trembling of the entire body, but they did not affect his consciousness. The weakness of the extremities increased, and death, preceded by fever and delirium, supervened two months after the injury. A soft lobulated carcinoma occupied the entire upper vermiform process of the cerebellum, its posterior portion only

[1] "Ein Fall von Hirnabscess," *Arch. f. Heilk.*, vol. xvii.; *Virchow-Hirsch*, vol. ii., 1, p. 104.

[2] "Verhärtung d. linken Haelfte der Varols-bruecke," *Nassau. Med. Jahrb.*, H. 3, p. 142; Canstatt's *Jahrb.*, vol. iii., p. 90.

[3] "Ueber Krankheiten des Kleinen Gehirns, *Dissert.*, Tuebingen, 1858; see Wernicke, vol. iii., p. 356.

being preserved. One part of the tumor of the size of a nut extended forward and covered the corpora quadrigemina, completely flattening the right pair and diminishing the size of the entire crus cerebri. A tumor as large as a bean was also situated upon the left optic nerve between the eyeball and the chiasm. The cerebral convolutions were flattened, and the lateral and third ventricles were considerably enlarged.

CASE 33, Garrod and Philpot.[1]

A papilloma of the fourth ventricle gradually developed after a contusion of the head. The symptoms were atactic disturbances of the limbs, right convergent strabismus, right facial paralysis and the gradual development of blindness.

Perhaps we might also add the case of Jantet.[2]

A severe injury was followed by facial paralysis, pain and tinnitus of the right ear, with a discharge of serous fluid (at first bloody) from the ear, lasting for four days. On the ninth day the patient returned to his work. The headache soon returned with great severity. The right eye became immovable after having at first shown only strabismus. The pupil was tardy and irregular. Death occurred on the fifty-first day. There was yellow softening of the frontal lobe with fresh clots in the lateral ventricle. A transverse fissure through the base of the skull was also discovered. There was no extravasation.

There is no statement concerning the kind of strabismus that existed at first, but the frequency of paralysis of the abducens in basal fractures gives the impression that this case is of the same kind and similar to those of Robert and Jacobi.

B.—Bilateral Paralysis of the Abducens.

CASE 34, of Maissoneuve's.[3]

Convergent strabismus developed in a man as a consequence of a fall upon the head. The eyeballs could be moved upward, downward, and toward the nose, but neither could be turned out-

[1] *Lancet*, March 1st. *Virchow-Hirsch* for 1873, vol. ii., 1, p. 71.
[2] *Gaz. méd. de Lyon*, see Canstatt's *Jahresb.* for 1853, vol. iv., p. 49.
[3] Canstatt's *Jahresb.* for 1841, ueber die Fortschritte der Augenheilk., p. 89.

ward. The vision of the left was likewise impaired. Maissoneuve diagnosticated paralysis of the external recti muscles from injury of the sixth pair of nerves. An operation on the left eye placed the eye in a proper position, though the eye could not be moved to either side. A subsequent operation was to be performed on the right eye.

In this case it is certain that there was direct injury of the sixth pair. But it is a question whether they were simply torn off or injured by fragments of bone. The transient visual impairment probably depended upon an extravasation within the optic foramen or in the orbit. There was probably a fracture of the base.

CASE 35, of Kétli.[1]

A driver and his horses fell over a precipice, one of the latter falling upon a man's head. He was unconscious for three days and there was bleeding from the mouth and from the left ear. On recovering consciousness, he suffered with diplopia and produced giddiness when he walked, and he was almost completely deaf; he had intense tinnitus. Six weeks later his condition was as follows: Both sides of the face smooth, folds obliterated, mouth closed, muscles of mastication normal, mouth dry ("because of insufficiency of saliva"), sense of taste in anterior half of tongue entirely lost, sensibility in all parts of mouth normal, movement of the soft palate normal. There was also paralysis of both abducentes; the ophthalmoscopic appearances were normal; there was complete deafness of the left ear and almost complete deafness of the right with intense tinnitus. The galvanic examination indicated simple hyperæsthesia of the left acoustic nerve. Both drumheads were ruptured and there was a puralent secretion with sequestered particles of bone in the left drum cavity. Otherwise, there was no abnormality and his general condition was good.

The author believed that there was a fracture of both temporal bones in the region of the middle ear, thus injuring the facial nerve below its bend. He considered the seat of the paralysis of the abducentes, doubtful. We shall revert to this case below.

[1] *Wiener med. Presse*, 1875, No. 19; *Virchow-Hirsch*, vol. ii., 1, p. 107.

CASE 36, of Church.[1]

"Bilateral paralysis af the abducentes, with transient deafness, from crushing of the head between the bumpers of two railroad cars." Though the details are not given in the summary, we are justified in assuming that there was a fracture of the base even though the facial nerve was not paralyzed.

CASE 37.

A. M., fifty-four years of age, first came under my observation, February 10, 1884.

Previous History: The patient who had been perfectly well and had enjoyed good sight was struck eight weeks previously while felling trees, having been struck upon the crown by a falling tree. He fell to the ground and remained unconscious for eight days. He did not vomit. The left side of the body was paralyzed, facial paralysis was not noted. The paralysis disappeared, but then the patient began to complain of general debility, vertigo, mental confusion, and of increasing visual impairment.

Present Condition: The patient is of medium size, his nutrition moderate. He complains bitterly of his mental confusion and his visual disturbance. His psychic condition is shown by his bearing to be quite abnormal. He knows nothing of the accident. The right eye is turned at least 3.5 *mm* toward the inner side, the left at 6 *mm*. It is impossible to move either eye out of its convergent position, though in associated movements the eyes are moved still farther inward. There are frequent jerky contractions of the left internal rectus and more rarely of the right internal rectus. Upward and downward movements of the eyeballs are fair; in consequence of the high degree of convergence, these movements are associated with considerable rotation; thus when looking upward the upper end of the vertical meridian inclines toward the nasal, when looking downward it inclines toward the temporal side. There is complete paralysis of both abducentes, but paralysis of the other ocular nerves cannot be made out. The pupils are equal, slightly contracted, and react normally. V, R E: $\frac{6}{xii}+$; V, L E: counting of fingers at $\frac{1}{4}$ *m*. The peripheral field of vision and the light

[1] "Paralysis of the Sixth Pair," *Phila. Med. and Surg. Report.*, 1873; *Virchow-Hirsch* for 1873, vol. ii., 2, p. 508.

are normal. To the right eye, green appears in a large part of the field as blue, orange as red, and yellow as yellow. To the left red and blue appear as such, but green appears blue, yellow bluish, and orange red. Diplopia cannot be made out and seems never to have been present, but the projection of either eye is entirely false. Both optic discs are somewhat pale, have sharp margins, and slightly contracted blood-vessels. There are no traces of injury about the head. Sensory disturbances in the region of the trigeminus or disturbances of other cranial nerves are not discoverable. Speech and the muscles of swallowing are not affected. Nor are there any sensory or motor disturbances of the trunk or extremities. No diabetes mellitus. The patient was allowed to return home but presented himself again on July 31, 1884, for treatment of his eye trouble. He now complained of frequent attacks of vertigo and slight headache (once or twice weekly), which lasted from one half to an hour. His vision was not affected during these attacks. His general condition was good, excepting the visual disturbance which disabled him.

Present Condition: The convergence of both eyes has increased. Attempts to move the right eye outwards produce a rotation of the eye, the upper end of the vertical meridian inclining toward the nose. V, R E : $\frac{4}{xii}$; V, L E : counting of fingers with difficulty at *2 m*. The left eye recognizes no colors excepting red ; yellow appears "light" and blue as "dark." The right eye constantly mistakes yellow and blue in a small part of the field.

August 2d: Tenotomy of the left internal rectus and advancement of the very atrophic external rectus. The operation resulted in almost restoring the eye to its primary position.

August 6th: The defect has decreased so that the eye is still convergent. V, L E : $\frac{4}{xviii}$, and all colors can now be recognized with this eye. The fields of vision are normal. Both optic discs are pale, especially in the macular half.

April 22d: The convergence of the left eye measures about *2 mm*, the condition of the right eye being unchanged.

April 25th: Tenotomy of the right internal rectus and advancement of the external rectus with fixation of the eyeball in a divergent position by means of a thread attached to the stump of the internal rectus muscle, and drawn outwards (allowed to remain three days). The result was perfect and the patient was able to resume his work as a day-laborer.

A fracture of the apices of both temporal pyramids with tearing off of the abducentes appears to us as the most probable diagnosis. The hemiplegia was undoubtedly due indirectly to an extravasation, probably at the base of the skull (possibly in the cortex, for we could not discover whether motor paralysis existed alone). The apparent improvement of the vision of the left eye, after correction of its malposition, depended upon central fixation which thus became possible. It is not certain that the peculiar disturbance of the color sense had not existed previously.

CASE 38.—Mauthner.[1]

A man fell from the driver's seat of a hack, upon the occipital part of his head. He immediately arose without any apparent injury; but soon observed that objects appeared to be double. An examination showed that both external recti muscles were paretic, due probably to a circumscribed traumatic hemorrhage in the median line of the floor of the fourth ventricle, thus affecting a part of the nuclei of both nerves. No other explanation would be satisfactory. The patient was not seen subsequently.

Mauthner's case would thus belong to the same class as those of Wahl, Hirschberg, Mooren, Panas, and Steinheim. The following case is similar.

CASE 39, of Emerson.[2]—From the summary in Hirschberg's *Centralblatt*, we learn only that "there was in one case complete paralysis of both abducentes following a stroke of lightning."[3] The production of bilateral abducens paralysis by lightning is of special interest. There is no doubt that the lesion was traumatic, and that its seat was nuclear.

CASE 40, Landesberg,[4] reported a case of traumatic hemorrhage at the base of the skull which caused paresis of both abducentes.

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[1] *Die Nuclearlähmung der Augenmuskeln*, Wiesbaden, 1885, p. 375.

[2] "Statistics Illustrating the Etiology of Paralysis of the Ocular Muscles," *N. Y. Med. Jour.*, 1886, part I, p. 520.

[3] The patient was a woman, aged sixty-three, who had been struck by lightning fifty-eight years before. There was complete paralysis of both abducentes ever since.—[TRANSLATOR.]

[4] *Virchow-Hirsch*, 1874, vol. ii., 2, p. 617.

CASE 41. We are able to give only the title of Bowater's[1] case "paralysis of the sixth nerve on each side after an injury on the head."

The two following cases of Galezowski appear to indicate a nuclear origin more definitely.

CASES 42 and 43.[2]

Bergmann quotes these in the following manner: "Of special interest are those traumatic paralysis of the abducens which subsequently involve other nerves. Galezowski (*Traité des Maladies des Yeux*, Paris, 1872, p. 778) has described two such cases. At first the abducens alone was paralyzed, a month later the facial of the same side and the other abducens became paralytic. The head injury in these cases probably caused an apoplectic lesion in the floor of the fourth ventricle, around which there was subsequent softening. The nuclei of the facial nerves lie near the origin of the sixth pair; an infiltration or a degeneration extends from the one to the other. In those cases of paralysis of the facial and abducens, following a blow on the head, the diagnosis of hemorrhage in these centres becomes very probable, when there are no other signs of fracture of the petrous portion of the temporal bone, and when the acoustic nerve is not paralyzed (this was observed by Leared, *Lancet*, 1869, vol. i., March 6th).

This view is scarcely tenable in the following case in which both oculo-motor nerves became paralyzed successively.

CASE 44, Ziemssen.[3]

A man had his head caught in a threshing machine, which compressed the skull. This resulted in hemorrhage at the base of the skull (diagnosis), in paralysis of the left facial, oculo-motor, and abducens, and subsequently (perhaps as the result of a subsequent hemorrhage) paralysis of the right abducens, and partly of the right oculo-motor.

Considering the force and the *gradual compression*, it appears probable that there was a basal hemorrhage, and perhaps a fissure of the base. Hemorrhage in the cerebrum

[1] *St. Barthol. Hosp. Rep.*, vol. vi., p. 234. *Virchow-Hirsch* for 1868, vol. ii., p. 503.
[2] *Pitha-Billroth*, vol. iii., 1 A., p. 235.
[3] *Virchow's Archiv*, vol. xiv.

itself and direct injury of the nuclei are rather to be expected when the force is *suddenly* applied to the head. The subsequent paralysis of the opposite side are ascribed by Ziemssen to probable secondary hemorrhage. The termination and recovery likewise accords with the assumption of basal compression of the nerve front.

CASE 45, G. May.[1]

A girl nine years old fell from a ladder upon her occiput. Fourteen days later her speech became difficult; she suffered with nausea, especially in the morning; there were symptoms of chorea and at times she would even fall. There was convergent strabismus, especially of the right eye. Her general debility forced her to keep to her bed for three months; her right arm and leg became stiff and paralyzed, the extremities of the other side being affected to a less extent. At times there were convulsions, but her intelligence and the senses were unaffected. Then coma followed convulsions, and death ensued six months after the fall. An abscess was found in the right side of the pons, with ulceration of its entire surface, and hyperæmia of the meninges. The right abducens was entirely destroyed, the left probably.

CASE 46, Kirchhoffer.[2]

A gun-shot injury in tangential direction of the right parietal protuberance produced fracture of same and left hemiplegia and aphasia. On the eighth day after the injury, sequestra, which had pierced the dura mater, were extracted. Consciousness and speech (stammering) gradually returned. At this time the patient constantly desired to be turned on the other side, and had convergent strabismus of both eyes. He died of exhaustion, and a cerebral abscess as large as the fist was found at the seat of the injury, and the pons was softened.

RÉSUMÉ OF THE CASES OF INTRACRANIAL TRAUMATIC PARALYSIS OF THE ABDUCENS.

Twenty-seven of the forty-six individuals were males, two were females; there is no note concerning the sex in seven-

[1] "Disease of the Pons Varolii," see Canstatt's *Jahresber.* for 1854, vol. iii., p. 31.

[2] Beobachtungen, etc., während des Feldzuges von 1866. Zurich. *Virchow-Hirsch*, 1868, vol. ii., p. 332.

teen; we shall, however, make no great error by counting these to the males. The great difference may be explained by the fact that men are by far more frequently subjected to dangerous accidents.

The right nerve was injured eleven times. The left, twelve. Both were injured thirteen times. In seven cases of unilateral paralysis, the side is not designated. In three cases (Heyfelder, Gelpke, and Griesinger) strabismus alone is mentioned; it cannot, therefore, be decided which was the affected side. It is evident that there is no predisposition of one side of the head.

In thirty-seven of the forty-six cases, the paralysis was most probably the direct consequence of the trauma. In nineteen of these thirty-seven, the disturbance persisted, and in nine there was recovery. In nine cases there is no note concerning the result.

In eight cases the paralysis was secondary. We cannot decide this question in the cases of Thomson and Heyfelder.

RESULTS OF POST-MORTEM EXAMINATIONS.

Eleven of the cases were fatal; of these, however, only four were primary paralyses. We have reports of the post-mortem examinations of all eleven, but those of the primary cases are alone of much interest, and of these the two classical cases of Robert and Jacobi are of greatest value, for the notes in Aran's and in Kroenlein's cases are too imperfect.

In six of the cases examined *post mortem*, the paralysis was secondary; the cause of the paralysis being: abscess of the brain (three times), induration (once), and neoplasms (twice). In Heyfelder's case in which it is uncertain whether the paralysis was of a primary or secondary character, an abscess is found.

In the four primary cases there was once fracture of the clinoid process and transverse fracture of the petrous portion of the right temporal bone, with direct rupture of the nerve in the line of the fracture (Robert).

In the second case (Jacobi) there was also fracture of the sphenoid bone and petrous portion of the temporal bone. It

was not clear at the examination whether the abducens itself was torn, stretched, or compressed.

In the third case (Aran) there was shattering the petrous portion of the right temporal bone; the abscess found around the bullet in the right hemisphere and the softening and injection of the sixth pair of nerves, seem to be of subordinate importance in this connection.

In the fourth case (Kroenlein) there was fracture of the base, but this seems to have had no direct bearing upon the abducens nerve, for it was situated on the opposite side.

SEAT OF THE LESION.

(Etiological Factors of Mauthner's First Category.)

We are unable to specify the seat of the lesion of the abducens in all our cases with certainty, and must be satisfied in many cases with assumptions. In the following, the presumptive factors (of the first category) are classified according to their numbers.

Basal		in 17 cases
Cerebral	Nuclear	12 "
	Nuclear or basal	9 "
	Perhaps fascicular	1 "
	Possibly cortical	3 "
Indefinite		5 "

It is evident that the basal and nuclear lesions form the great majority, the basal probably predominating. Too much reliance, however, dare not be placed upon these figures. One or the other of the cases perhaps belongs to another category. A sharp division of basal from nuclear paralysis is often impossible because of the possibility of combined causes of the paralysis.

ANATOMICAL CAUSE OF PARALYSIS.

(Etiological Factors of Mauthner's Second Category.)

Fracture of the base may certainly be regarded as the cause of sixteen of our cases, as the very probable cause of fifteen others; in two (Thomson and Kirchhoffer) there was

fracture of the vault of the skull, which is often complicated with fracture of the base; in two further cases there was injury of the vault of the skull by a stab wound, and it was only in thirteen cases that there was perhaps no breach of the skull. Breaches of continuity of the skull are therefore the most important facts, especially of fractures of the base; this is to be expected when we consider the conditions surrounding the abducens.

Direct division of the nerve trunk is to be considered as the most important lesion. The anatomical proof of the occurrence of this lesion was given in Robert's case. The nerve is certainly most in danger where it passes over the apex of the petrous portion of the temporal bone and leaves the ascending direction to take a horizontal course; this has been pointed out by Panas.[1]

We believe, however (with Duret and Gorecki[2]), in the possibility of tearing off of the nerve as it leaves the brain substance in the form of fine threads, though its occurrence has not been demonstrated. We are of the opinion that this may occur without a fracture.

The assumption of a direct laceration of the nerve is certainly justified in those non-fatal cases in which the paralysis came on immediately after the injury and remained permanent, as in the cases of Armaignac and Nieden (Case 7), Diberder, Wagner, Maisonneuve, Kétli, and our own.

In five of these cases, and probably in a sixth, loss of consciousness followed the accident; this points to a severe injury. In the other cases in which the paralysis likewise followed immediately upon the injury, but subsequently disappeared, we are compelled to assume compression by hemorrhage, or stretching of the nerve.

Basal hemorrhages may affect the nerve at different points at the base of the skull. They are of special interest when they are situated at the posterior margin of the pons, in the region where both abducentes lie very close; both may thus become paralyzed by a single hemorrhage. The possibility of the direct affection of both nerve roots by a hemorrhage

[1] *Arch. d' opht.*, 1881, vol. i., p. 3.
[2] *Revue générale d' opht.*, vol. i., No. 1, p. 58.

must be admitted, though it would be hard to distinguish this lesion from that produced by a hemorrhage in the nuclear region. It is especially difficult to make this differentiation, as the abducens supplies one muscle only, and not several, as does the oculo-motor; the question therefore must be decided in cases of complete paralysis by considering all the other signs.

The etiological factors (of the second category) of basal paralysis which develop secondarily are: secondary hemorrhage (Ziemssen), sinking of extravasated blood from the lateral part of the skull to the base (Sachs); according to Mauthner: pachymeningitis with or without fracture of the base and suppurative basal leptomeningitis; and, according to Strohmeyer,[1] inflammation of the neurilemma, neuritis and softening of the nerve trunk (Aran), compression by abscesses of the brain and possibly also by neoplasms of traumatic (?) origin, and finally by the formation of callus at the base of the skull, are to be added.

We shall now take up the second important group of factors of the first category, viz., the cerebral, beginning with the nuclear paralysis. The lesions to be considered in the primary cases are: laceration of, and more especially hemorrhage in, the brain substance. We may add parenthetically that a basal hemorrhage may affect the nuclear region from a distance, and also that a basal hemorrhage may be associated with a nuclear lesion. A nuclear cause was emphasized by Mauthner and Steinheim in their cases. The bilateral cases of Landesberg and Emerson (possibly), and the unilateral ones of Hirschberg, Mooren, Panas (twice) (?) Wahl, (perhaps) (?) may be added to this category.

As etiological factors (of the second category) of the secondary nuclear paralysis may be mentioned: softening of the brain substance around traumatic lesions (Galezowski), the formation of an abscess (Heyfelder, Gelpke, May, Kirchhoffer), other changes of tissue, and, finally, neoplasms of the brain substance (Griesinger, Garrod, and Philpot).

An intermediate position between the cases of primary and those of secondary origin is occupied by those in which

[1] *Vorlesungen über med.-chirurg. Krankheiten des Kopfes.* Vienna, 1864.

the first abducens is paralyzed by a hemorrhage at once; the second one, later, probably from softening. Such are the cases of Galezowski (and perhaps also that of Ziemssen).

The etiological factors (of the second category) to be considered in fascicular paralysis are the same perhaps as in the nuclear. Kniesling's case might find its place here.

The etiological factors of primary cortical paralysis are mechanical injuries especially, and hemorrhages of the convexity of the brain. The factors of secondary cortical paralysis are: meningitis, the formation of abscesses, softening, and perhaps neoplasms. If we mention the cases of Nieden, (Case 6), Thomson, and Heyfelder as being of possible cortical origin, it is meant only as a possibility.

OCCURRENCE OF TRAUMATIC PARALYSIS OF THE ABDUCENS.

Inquiring into the different etiological factors of Mauthner's third category, we obtain the following forms of injury:

(a) *Cases of unilateral paralysis:*

In seven cases a fall from a considerable height,
" nine, severe injury of the skull by a blow,
" two, stab wounds,
" one, fall from a wagon,
" one, fall from a horse,
" one, severe contusion of skull by pressure,
" one, pistol shot,
" one, fall on the occiput,
" one, fall on the head,
" nine, severe injury of the skull without further details

(b) *Cases of bilateral paralysis:*

In two cases, a fall on the occiput, one from a coach-box, and once from a considerable height,
" one, bruising between railroad bumpers,
" one, crushing by the body of a horse,
" one, a fall on the head,

In one, injury in a threshing machine,
" one, gunshot injury,
" one, severe blow,
" one, a stroke of lightning,
Four cases are not detailed.

The thirty-two cases of unilateral paralysis were complicated with paralysis of other cranial nerves as follows [1]:

In two cases	II.
" one case	**II** (?)
" one case	II. **II**
" one case	II. **II.** VIII.
" one case	II. **II.** VIII. **VIII**
" one case	II. IV. VIII
" one case	II. VIII
" two cases	III.
" two cases	V.
" one case	V. VII.
" two cases	V. VII. VIII.
" one case	V. VII. **VIII.**
" one case	VII.
" one case	**VII.**
" one case	VII. VIII. **VIII.**
" two cases	VIII.
" one case	Perhaps X and XII.
" eight cases	*The paralysis was isolated.*
" four cases	The details are wanting.

Of other complications there are mentioned

In three cases	Crossed hemiplegia
" one case	" motor paralysis
" four cases	Hemiplegia of same side
" one case	Atactic symptoms
" two cases	Aphasia
" one case	Conjugate deviation
" one case	Nystagmus of the same side
" four cases	Polyuria.

[1] The heavy Roman figures refer to paralysis of the cranial nerves, that occurred on the side opposite to that upon which the abducens was affected.

In the thirteen cases of bilateral paralysis we find the following cranial nerves associated in the affection [1]:

In one case	II.
" one case	III. VII. and later **III.**
" two cases	VII.
" one case	VII. VIII. **VII. VIII.**
" one case	Probably X and XI.
" four cases	*The paralysis was isolated.*
" four cases	There are no notes ; perhaps the paralysis was isolated.

Hemiplegia is mentioned in three cases (in one of these also hemiparesis of the other side) (May).

A RÉSUMÉ OF THE ASSOCIATED PARALYSES OF THE CRANIAL NERVES.

Let us now consider briefly the affection of each cranial nerve separately, as found associated with paralysis of the abducens. Thirty-eight of our cases only are sufficiently explicit to be of service.

The Optic Nerve

was affected nine[2] times, *i. e.*, in almost one quarter of the cases —a very large percentage. If the optic nerve of the same side is affected, it would almost certainly depend upon the simultaneous injury of the optic canal or a continuation into it of the basal fracture. The latter seems very reasonable to Berlin, who states that, according to Hoelder, the optic canal was shown to be fractured in 53 cases out of 86 fractures of the base of the skull. We should therefore expect an associated affection of the optic nerve only when there is a basal lesion. On the other hand, an optic nerve lesion will make the diagnosis of a basal affection of the abducens very probable. Cases of bilateral lesion of the optic nerve are, according to Berlin, to be referred to fracture of the

[1] The heavy Roman figures in this list refer to paralyzed cranial nerves on one side of the head—the light those of the other side.

[2] Including Jacobi's case.

sella turcica and one optic canal; fracture of both optic canals would be a rare exception.

Transient disturbances of vision after such injuries, not due to any affection of the eyeball itself, are most often to be ascribed to hemorrhages around the optic nerve, which are subsequently absorbed. On the other hand, permanent blindness or defects of the field of vision are due to compression or tearing of the nerve or chiasm. It may appear remarkable that in 8 of our 9 cases of amblyopia or amaurosis, the disturbance of vision occurred on the same side as did the paralysis of the abducens. At the same time it must be mentioned that in 3 of these 8 cases there was also visual disturbance of the other eye and in 2 of these the latter was the more severe.

According to Wahl's statements we would suppose—though it is opposed by the cases presented—that a lesion of the optic nerve of the opposite side or of both nerves would more frequently result from those injuries which produce paralysis of the abducens with fracture of the base. The proposition that a fracture of the petrous portion of the temporal bone has a greater tendency to extend into the optic canal of the same side rather than into the opposite one is entirely false.

There is one fact which can hardly be looked upon as a simple coincidence: but a single case of the thirteen of bilateral paralysis of the abducentes presented a lesion of the optic nerve seems to have occurred, and even this one is not certain; if it did occur it was unilateral.

Forces, which are apt to produce longitudinal fractures, especially such that pass through the petrous portions of both temporal bones, appear to have little tendency to extend the line of fracture into the dangerous region in front.

2.—*The Oculo-motor Nerve.*

This nerve was injured but three times (even if Mooren's case is included—though it is very doubtful, there having been but paresis of the accommodation).

[1] "Ueber Fracturen der Schaedelbasis," Volkmann's *Sammlung klin. Vortraege*, 1883, No. 228.

The second case in which this nerve was affected is that of Gelpke, in which there was ptosis and hemiplegia on the same side. But the case is not clear and is of no service in localization.

The third case is that of Ziemssen and has been discussed. The reasons were given for a basal lesion (or possibly nuclear) of the oculo-motor nerves. It is evident that the association of traumatic intracranial paralysis of the abducens with paralysis of the III. nerve is rare. Cases of pulsating exophthalmus must naturally be accepted.

3.—*The Trochlear Nerve.*

We find paralysis of this nerve mentioned but once in our 38 cases. This is the case of Armaignac, in which there was likewise paralysis of the acoustic and visual disturbance, both on the same side. The author believes that both oculo-motor nerves were torn off, thus assuming a basal lesion. Paralysis of the trochlear nerve probably occurs more frequently in this connection, but is often overlooked because the symptoms are not striking (isolated paralysis of the trochlear nerve is not a rare consequence of trauma). We may expect this complication in especially those cases in which the fracture of the base is diagonal or even transverse.

4.—*The Trigeminal Nerve*

was paralyzed in five cases (perhaps in a sixth of Casper). It was always primary in unilateral paralysis of the abducens, and always occurred on the same side. Nieden believes that the conjoint lesions of the V., VI., and VII. pairs of nerves are especially remarkable. Besides Haase's and his own cases (in which the VIII. nerve of the opposite side was likewise paralyzed), this association of paralyses was also presented in Aran's and probably in Casper's cases (to which an affection of the VIII. nerve was likewise superadded).

These cases may be caused by fracture and direct injury of the nerve trunks at the base, especially when there is no crossed hemiplegia. When complicated by crossed hemi-

plegia the paralysis may still be basal, though an intrapontine or intrapeduncular lesion (*i. e.*, nuclear or fascicular) will be more probable (Casper's case).

Concerning the probable rarity of paralysis of the trigeminus in bilateral paralysis of the abducentes, we would reiterate what was said concerning the optic nerves.

5.—*The Facial Nerve.*

In 7 cases of unilateral paralysis of the abducens there was facial paralysis. In 6 of these the two paralyses occurred on the same side. In one they were opposite (Sachs). This nerve was likewise paralyzed in four cases of bilateral paralysis of the abducentes, being unilateral in three, bilateral in one (Kétli).

In 7 of the 11 cases the paralysis was primary; in 3 secondary. In Sachs's case this question must be left open; as the upper branch remained unaffected we infer a central lesion.

The primary cases are to be ascribed to a basal lesion, when there is fracture of the petrous portion of the temporal bone, or to a nuclear lesion. In those cases in which a blow on the head is followed by paralysis of the facial and abducens only, without paralysis of the acoustic, and without other signs of a fracture of the petrous portion of the temporal bone, Bergmann believes the diagnosis of a nuclear hemorrhage as most probable.

Of the 3 secondary cases 2 were to be ascribed to nuclear softening (Galezowski), 1 to neoplasm, likewise probably nuclear (Garrod and Philpot).

Paralysis of the facial nerve occurs more frequently in longitudinal than in transverse fracture of the petrous portion of the temporal bone, and not at all when the transverse fracture involves the apices alone. We therefore find it most frequently in injuries of the skull due to forces acting transversely or diagonally; less frequently when the direction of the force is sagittal, and more rarely still when the force has acted from above or below. We therefore conclude that the facial paralysis in Kétli's case was due to a transverse fracture of the base running lengthwise in the

petrous portion of both temporal bones,—the compression of the skull having been transverse. The affection of the acoustic nerves likewise argues in favor of this view.

The bilateral character of the facial paralysis in this case is of special interest. Bergmann could find but a single instance of this affection—*i. e.*, the case of Devaines's (Pitha-Billroth). In Maisonneuve's, and in our own cases of bilateral paralysis of the abducentes in which the fracture of the petrous portion of the temporal bones was probably transverse, the facial nerve was uninjured.

6.—*The Acoustic Nerve.*

Paralysis of the acoustic is mentioned in two of the cases of bilateral paralysis of the abducens, and both of these were bilateral; one was permanent, the other transient. The acoustic affection seems to be almost exclusively due to basal or peripheral causes. In by far the greatest number of cases it depended upon fracture of the petrous portion of the temporal bone.

What has been said concerning the relation of the facial nerve to the different kinds of basal fracture, likewise holds good for the acoustic. There is a great difference, however, between the nuclear paralyses. The nucleus of the VIII. nerve lies at a distance from that of the abducens. We should therefore expect a cerebral lesion of the acoustic, but as a very rare complication of paralysis of the abducens.

The association of paralysis of other cranial nerves is very doubtful. The vagus (?) and the hypoglossus are perhaps affected in rare cases.

Isolated Paralysis of the Abducens.

Those cases are of special interest in which there is no paralysis of other cranial nerves; such are probably the eight following unilateral cases: Robert, Diberder, Hadlow, Critchett and Juler, Hirschberg, Panas (two cases), and Steinheim. In one case (Robert), death took place; twice the condition was permanent (Diberder, Critchett and Juler), and five cases recovered. Mooren's case though

complicated with paresis of the accommodation, may find a place here; this case likewise recovered.

In Robert's case, the paralysis was caused by direct division of the nerve by a fragment of bone. In Diberder's case there was likewise a lesion of the nerve trunk due to the fracture. The lesion in Critchett and Juler's and in Hadlow's cases remains doubtful. In the remaining cases, the lesion was almost certainly nuclear.

Among the cases of bilateral paralysis we find that seven are probably isolated affections of the abducens. They are as follows: Maisonneuve, Church, Mauthner, Emerson, Landesberg, Bowater, and our own. The paralysis was permanent in two (Maisonneuve's and our cases), and persisted in all probability in two others (Church and Bowater). In the remaining three, there was probably recovery.

We are justified in assuming a tear of the nerve in the first four cases (all probably due to basal fracture) and a nuclear lesion in Mauthner's, Landesberg's, and Emerson's cases.

The diagnosis of a nuclear lesion in cases of isolated (unilateral or bilateral) paralysis of the abducens from injury of the skull is indicated when the affection is only a *paresis*, and when the signs of fracture of the base are absent. The probability of the diagnosis will be much greater if there is polyuria, as in Steinheim's case.

Frequency of Paralyses of Other Cranial Nerves in Cases of Traumatic Paralysis of the Abducens

is shown by the following numbers which include all our cases:

The	optic	nerve	was	affected	8	(9 ?)	times
"	ocular-motor	"	"	"	3		"
"	trochlear	"	"	"	1		time
"	trigeminal	"	"	"	5	(6 ?)	times
"	facial	"	"	"	11		"
"	acoustic	"	"	"	12		"
"	vagus	"	"	"	2	(?)	"
"	hypoglossus	"	"	"	2	(?)	"

Concerning Other Complications.

We find that hemiplegia occurred eleven times. In four of the eight unilateral cases thus complicated, the hemiplegia affected the side corresponding with the paralyzed abducens. Hemianæsthesia of the same side is likewise mentioned in two cases.

In one case (Garrod and Philpot), atactic symptoms in the arms and legs are mentioned. According to Nothnagel, ataxia is observed in rare cases in diseases of the pons, and such was found in the case just mentioned.

We find aphasia noted three times (Nieden 6, Sachs, Kirchhoffer), conjugate deviation of both eyes, once, unilateral nystagmus of the affected side, once, and polyuria, probably four times. We have already referred to the significance of polyuria. It occurred in Steinheim's case of isolated paralysis, in Nieden's cases (4 and 5), and in Jacobi"s.

Conclusion.

The general impression that we have obtained is that traumatic paralyses of the ocular muscles are not of very frequent occurrence in comparison to the frequency of head injuries. Still we admit that they are not seldom met with.

It is not surprising that little information concerning paralyses of the eye-muscles is found in the older works on surgery, and in surgical literature of former decennaries, even though paralysis of the abducens produces very striking symptoms. Many of the older authors were careful observers, but little attention was given to symptoms referable to ocular movements before the revival of ophthalmology. Moreover, the gravity of other cerebral symptoms following severe injuries would frequently hide the lesser eye-symptoms.

The relative frequency of bilateral traumatic paralysis of the abducentes is very remarkable. Were we justified in drawing conclusions from such small numbers (46), we should state that 28.3 per cent. of the cases were bilateral. Comparing these results with those of Emerson and Roosa, who found only 4.7 per cent. of their 64 cases bilateral, this

difference becomes very significant. The frequency of the bilateral occurrence of these paralyses may be explained by the fact that trauma acts locally more severely than other causes, while affecting a larger area. We should especially expect to find bilateral paralyses when a force acts symmetrically upon both halves of the head, as in crushing of the skull, or in those cases in which the force acts directly from above or below.

Wahl's treatise on *Fractures of the Base of the Skull* is very instructive in this connection. We learn from this author that the direction of a fissure depends upon the line of force, and that the anatomical arrangement of the bones is of secondary importance. We consequently find fractures of the petrous portion of the temporal bone parallel to the longitudinal axis of this bone, when the direction of the force acting upon the skull is transverse or diagonal. Bilateral paralysis is most easily produced when the direction is transverse (Kétli, Church), the body of the sphenoid bone thus receiving one or two fractures.

A diagonal force may cause a fracture running the length of the petrous portion of the temporal bone and extending in a diagonal direction through the body of the sphenoid to the optic foramen opposite. The other optic foramen may be injured at the same time by a second fracture beginning at this point and running parallel to the former fracture. Both optic nerves may thus be affected in unilateral paralysis of the abducens. A transverse fracture of the petrous portion of the temporal bone would be caused by forces acting in the line of the sagittal suture. There might then be likewise a transverse or longitudinal fracture of the sphenoid and a fracture of one or both foramina.

A similar injury of both petrous processes is produced when the spinal column is forced up against the occiput or when the crown is forced down in the same line upon the spinal column. In either case we find fractures of the occipital bone which encircle the foramen magnum in more or less symmetric lines. Wahl's drawings, Nos. 18 and 19, demonstrate that the apices of the petrous portion are especially liable to injury in this form of fracture.

It is not without interest to note that in 9 of the 12 cases of unilateral paralysis of the abducens in which the direction of the force was certainly lateral, the affection occurred on the side of the head upon which the injury was received. Adding the 2 cases of Panas, though the side is not stated, we learn that in 11 of the 14 cases of paralysis of the abducens produced by violence, this correspondence was observed. Were we allowed to judge from these figures, we would, with Panas, consider this to be the rule.

We should mention Nieden's statement that paralysis of the acoustic from fracture of the petrous portion of the temporal bone, as a rule, occurs on the side opposite to that receiving the injury — by contrecoup. In our 12 cases of acoustic paralysis it was found 3 times on the side injured, once it was bilateral though greater on the side of the injury, and only once it was opposite. The paralysis of the acoustic in these five cases was always on the same side as the paralysis of the abducens. There are altogether 9 cases of paralysis of the acoustic among the 33 cases of unilateral paralysis of the abducens, but of these 9, there is only 1 in which the paralysis of the acoustic and of the abducens do not correspond as to side. Since paralysis of the abducens and fracture of the petrous portion of the temporal bone, bear such close relations to each other, we might conclude that the lesion of the acoustic is also likely to be found on the side receiving the injury. We would not, however, allow such small figures to argue against Nieden's statement: moreover, according to Wahl, it is not the side of the head but the direction of the force upon which the consequences depend. Before passing an opinion we would therefore have to know not only the point of injury of the skull but also the direction of the force.

Should there not be a frequent coincidence as to side in unilateral paralyses of the VI. and VII. nerves, which can be determined only by a large number of observations, we should arrive at the conclusion (which is *a priori* probable) that fracture of the petrous portion of the temporal bone, which is closely associated with injury of the acoustic, must manifestly be of less importance for paralysis of the abdu-

cens, and that cerebral lesions consequently play a more important part even in those cases where there is fracture of the base.

We should furthermore emphasize the relative frequency of primary paralysis or at least of the final persistence of isolated intracranial paralysis of the abducens—without paralysis of other cranial nerves and without other cerebral symptoms. There are 15 or 16 such cases among our 46, thus forming one third of the total number.

In conclusion, we may mention that intense contraction of the antagonist developed with remarkable rapidity in those cases in which the paralysis was not transient but persisted for some time. We should not like to decide whether this is a typical symptom of traumatic paralysis of the eye-muscles, still it bears a striking contrast with the fact emphasized by Mauthner, that contraction of the antagonist is not noted in congenital paralysis of the abducens.

TRAUMATIC PARALYSIS OF THE ABDUCENS NERVE.

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ASSOCIATE PROFESSOR OF DISEASES OF THE EYE AND EAR, COLLEGE OF PHYSICIANS AND SURGEONS.

(With a temperature chart.)

THIS subject has been so thoroughly discussed by Purtscher in the article which we have translated for this number of the ARCHIVES, that we shall limit our paper to the more recent cases and to the report of an interesting and unique one which we have recently had under observation.

Since Purtscher's paper was published in the German edition of the ARCHIVES, the following cases[1] have been reported.

CASE I.—Genouville[2] observed a case of transient strabismus due to paralysis of the abducens, in which the post-

[1] We shall not include any orbital cases in our lists. D'Oench published "A Case of Traumatic Paralysis of the Abducent and Oculo-motor Nerves," "probably to be attributed to a hemorrhage at the apex of the orbit." (*N. Y. Med. Record*, April, 1891, p. 402.)

Mention should also be made of cases of paralysis of the abducens due to forceps delivery. Bloch ("Abducens-Laehmung durch Zangengewalt, etc., *Centrabl. f. Augenheilk.*, 1891, p. 134) has collected three such cases from Hirschberg's records: In one there was paralysis of the left abducens with neuro-retinal atrophy, in the second, paralysis of both abducentes, in the third paralysis of the left abducens. All were very difficult forceps deliveries, and had permanent scars showing the compression. The author thinks that the lesion in these cases is probably orbital (injury of the muscle of the nerve); but that a basal or a nuclear is also possible. From the character of the scars over the parietal bone, and the paralysis being bilateral, we are led to believe that the second case was due to a lesion similar to that in Eaton's case, see below.

[2] *Archiv. d'Ophthalmol.*, 1893, summarized in *Hirschberg's Centralbl.*, 1893, p. 215.

mortem examination showed that the apex of the petrous bone had been broken off and that there had been a hemorrhage which had pressed upon the abducens nerve.

This case becomes particularly interesting when compared with those of Robert and Jacobi.[1] In both of the latter there was likewise a fracture through the apex of the petrous bone but the nerve was also severed in the line of fracture; in Genouville's case, the nerve was compressed by a blood-clot. In the first two, the paralysis was permanent while it was "intermittent." G. applies the case to support Panas's theory that the nerve is most exposed to danger at the apex of the petrous bone.

CASE 2, Koehler.[2]

A man aged thirty-four, was injured in an explosion, sustaining a fracture of the skull. Blood and cerebro-spinal fluid escaped from the right ear. This was followed by partial paralysis of the right facial nerve (which rapidly disappeared), complete paralysis of the right abducens, and paresis of the left arm and leg.[3] Within two months the abducens paralysis had almost disappeared.

There was fracture of the temporal bone in this case. The combined paralysis of the abducens and of the facial (without any involvement of the acoustic), together with the paresis of the left arm and leg, cannot be ascribed to a single lesion. Koehler assumes as the must reasonable explanation that the abducens nerve was stretched at the point where it enters the cavernous sinus (that is, at the apex of the petrous bone), that the facial nerve was injured in the temporal bone, and that the paresis of the extremities was

[1] See Purtscher's article.

[2] *Berlin. klin. Wochenschr.*, 1891, p. 433. Koehler had another case of traumatic paralysis of the abducens, but it belongs to the category of those associated with pulsating exophthalmus (see Purtscher's article). It is described by Strauch ("Ueber Laehmungen des Nervus abducens bei Bruechen der Schaedelbasis," *Inaug. Dissert.*, Berlin, 1892). A gunshot injury of the hard palate was followed by facial paralysis on the fourth day; on the tenth day all of the muscles of the left eye became paralyzed and one month after the injury pulsating exophthalmus made its appearance. The paralysis of the abducens alone was permanent.

[3] There is some confusion as to the side, but it appears that the left is meant.

caused by a contusion (with or without hemorrhage) of the right molor region of the cortex.

CASE 3.—Fuchs[1] reports

The case of a girl aged fourteen who fell when she was three years old and fractured the skull. Permanent paralysis of the left facial and abducens, and paresis of the acoustic and of the motor portion of the trigeminus resulted.

This combination of paralyses was perhaps due to a basal fracture, producing severe injury of the abducens, though a nuclear lesion would serve equally as well or better as an explanation of the peculiar combination of paralysis.[2]

The following three cases were published by Schroeder.[3]

CASE 4.

The patient aged thirty-one, fell upon the occiput and sustained a fracture of the skull. There was *immediate* paralysis of the left abducens and hemorrhage from the left ear. These were the only symptoms. The diagnosis was fracture of the base with tearing of the abducens at the apex of the petrous bone, as in the case of Robert.

S. excludes a nuclear lesion on the ground that there were no other symptoms of injury of the brain or of the cranial nerves. It is interesting to note the reference to the contraction of the internal rectus which appears to be of early occurrence in these cases.

CASE 5.

Age of patient twenty-six. Fell from a height, receiving a wound in the left parietal and occipital regions. There was hemorrhage from the left ear, left nostril, and from the mouth,—and primary paralysis of the left abducens.

The author concludes that paralysis was not nuclear, as other nerves would have been involved, and that the nerve

[1] *Wien. med. Wochenschr.*, 1890, No. 9.

[2] A point of great interest in this case is the high degree of myopia of the affected eye due to the tension of the optic nerve upon the very much adducted eyeball.

[3] *St. Petersburg. med. Wochenschr.*, 1891, p. 389.

was not torn, for the paralysis was not complete and improved greatly in a few weeks. It is probably to be ascribed to a basal hemorrhage, but we do not think that a nuclear lesion is impossible.

CASE 6.

The patient, aged thirty-three, fell upon the right side, a tree falling upon his left ear. There was hemorrhage from the left ear, sugillation of the right eye, anæsthesia of the left side of the face, and complete primary paralysis of the left abducens. The hearing of the left ear was impaired.

Great contraction of the internal rectus is likewise mentioned in his case. The author concludes that there was a transverse fissure, running along the anterior surface of the petrous bone toward the apex, and continued under the Gasserian ganglion. It may have extended into the middle ear. The abducens nerve was probably torn, for the paralysis was complete and permanent. The paralysis of the sensory portion of the trigeminus was ascribed to compression of the Gasserian ganglion from hemorrhage.

CASE 7.—Feilchenfeld[1] reports that a boy aged sixteen fell back, striking his head. When he recovered consciousness at the end of half an hour, there was complete paralysis of the abducens, without any other cerebral symptoms. The paralysis disappeared in one month. F. attributes the paralysis to a nuclear (or a cortical?) lesion, probably a small hemorrhage.

We have notes of a case of Liersch (*Deutsch. mediz. Zeitung*, 1891, referred to by Strauch, *loc. cit.*). An injury was followed by a large scar on the left side of the head and paralysis of the right abducens, but the data are not sufficient to be of value; we shall therefore not include it in our list.

CASE 8.—Ferri[2] reports a case of bilateral paralysis of the abducens, due to injury of the skull. He ascribes it to

[1] *Zehender's klin. Monatsbl.*, 1890, p. 180.
[2] *Annali di Ottalmologia*, 1889, rev. in *Centralbl. f. Augenheilk.*, 1889, p. 342.

basilar lesion, "in opposition to Mauthner, who believes traumatic bilateral paralysis of cranial nerves, especially of the abducens, to be of nuclear origin."

CASE 9.—Claes[1] relates that a child 2¼ years of age fell from a third-story window and fractured the occipital bone. She became unconscious, but there was neither vomiting nor a flow of cerebro-spinal fluid from the ears or the nose. Ptosis of the right eye, bilateral paralysis of the abducentes, right hemiparesis, aphasia, and blindness of both eyes were noted in a few days. A month after the accident the occipital bone was laid bare, and the depressed fracture and extensive fissures, as well as a small prolapse of brain substance (part of the cuneus or the first occipital convolution), were discovered; the depression was raised. Almost all the symptoms disappeared within a few weeks after the operation, and there was finally only pallor of the left papilla. The blindness was certainly due to cortical injury, but it would be difficult to localize the other symptoms. The paralysis of the abducentes combined with that of the levator indicate a nuclear lesion; the primary character and the recovery lead us to conclude that the lesion was due to a hemorrhage.

CASE 10 was reported by Eaton.[2]

A man aged 24 was injured by the caving of a stone bank, a large boulder striking him on the left side of the head and felling him to the ground. It required several men to remove the rock from his head and shoulder. In about two hours he became conscious, and an examination disclosed an extensive fracture, involving the left parietal and the left side of the frontal bones, and extending downward behind the left ear. The lower edge of the fracture was slightly depressed. There was hemorrhage from the right ear and also from the nose, which continued intermittingly for several days. He recovered entirely, excepting from the complete paralysis of both abducentes, which had come on immediately, and the partial paralysis of the sensory root of both trigeminal nerves; both paralyses were permanent. From the

[1] *Berlin. klin. Wochenschr.*, 1891, p. 920.
[2] *N. Y. Med. Record*, May 30, 1891.

description it is evident that there was a high degree of contraction of the antagonists. The right internal rectus was tenotomized and an advancement made upon the external rectus with great benefit; it appears that the contraction of the left internal rectus was also markedly lessened, as a consequence of this operation.

The author concludes that the lesion to account for the bilateral paralyses was situated at about the middle of the dorsum sellæ of the sphenoid, at about the point where the sixth pair pierces the dura mater. We agree with him that a basal lesion is the probable explanation; the line of fracture was transverse (according to Wahl's rule), and extended across the dorsum sellæ into the apex of both petrous bones, thus directly injuring the sixth pair (by laceration) and both Gasserian ganglia.

CASE II came under my own observation. It is particularly interesting, being a case of bilateral paralysis of the abducens, without any other nerve injury excepting partial paralysis of the sensory portion of the right trigeminus. The paralysis of the sixth pair was secondary and gradually disappeared, while the facial anæsthesia persisted for a long time.

H. M., aged forty, a car inspector, was injured Jan. 15, 1894, while coupling cars on the N. C. R. R., by having his head caught between two cars and violently compressed. The points of contact were the two parietal regions, so that the line of force was exactly transverse. He fell to the ground unconscious, and was soon after carried to the City Hospital and admitted to the service of Prof. J. W. Chambers. He was still unconscious. There were no external marks of injury about his head, but there was bleeding from both ears and from the nose. The left pupil was somewhat larger than the right. There was no paralysis, though the face appeared to be a little drawn to the side. Respiration was slow and stertorous, pulse 90, temperature 97°.[1] He was placed in bed, strychnia sulph. was given hypodermatically, and an ice-cap applied to the shaven head. The bowels were moved with calomel and an enema.

[1] The temperature chart is appended.

CLINICAL CHART

Baltimore City Hospital

NAME Martin AGE 39 DATE Jan. 15-94 No. —

DISEASE

18— DATES OF OBSERVATIONS.

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM

Cent. Fahr.

41° 106
40° 104
39° 102
38° 100
37° Normal 98
36° 96

Normal

Jan. 16*th*—He has partly regained consciousness, but can give no account of the accident. The bleeding from the ears continues, being most copious from the left; in the evening it ceased.

Jan. 17*th* there was again bleeding from both ears. During this time the ears were washed out daily with a solution of boracic acid and the dry powder was insufflated. There was slight deafness, which was attributed to the filling up of the ears with blood and the powder.

On *Jan.* 22*d* I was asked to make an ophthalmic examination. Both optic discs were normal; the left pupil was dilated and irregular, but both reacted to light; the left external rectus was paralyzed, producing homonymous diplopia, which he had not noticed before his attention was directed to it; it is therefore impossible to tell when this paralysis made its appearance, but it is quite certain that it was secondary and did not exist more than two or three days before I noted it, for he was frequently and carefully examined by the surgeons in whose care he was. His hearing was fair, considering that the ears were filled with powder; bone-conduction being greater than aërial, showed that there was no disturbance of the nervous portion of the acoustic organs.

Jan. 23*d* there was again slight hemorrhage from the left ear.

Jan. 27*th* a purulent discharge set in from the left ear, which continued, though slight in quantity, for several weeks.

Feb. 7*th* the patient was allowed to leave his bed for the first time, sitting up for half an hour. The paralysis of the left external rectus was complete, and there was a high degree of secondary contraction of the left internal rectus; a slight paralysis of the right external rectus was beginning to manifest itself.

Feb. 8*th* the patient sat up half the day. Paralysis of the right external rectus had increased greatly.

Feb. 13*th*.—The right external rectus was now completely paralyzed. The difference in the size of the pupils, mentioned at the beginning of the history, persisted unchanged. Marked secondary contraction of the internal rectus made its appearance at almost the same time, both eyes being turned far into the inner angles. V of both eyes good, that of the right being best.

March 13*th* the condition was the same.—It was noticed that when he attempted to move the right eye outwards, the eye would be rotated so that the upper end of the vertical meridian would incline toward the nose. The left eye did not act in this manner.

The paralysis of the left eye was now somewhat less than that of the right, but neither could be moved beyond the median line. The sensation of the skin was now examined into, and it was found that there was anæsthesia of the left side of the face, the parts involved being the left side of the nose, the left half of the upper lip, the left upper and lower eyelids, the left cheek to a line about as far back as that joining the outer angles of the right eye and the mouth. The right cornea and conjunctiva were likewise anæsthetic, so also the mucous membrane lining the right nostril, and the right half of the tongue; he also told me that the teeth of the right side of the mouth had a curious feeling—"as though they were pressed together." The difference in the size of the pupils was somewhat less than at first. Sight was almost perfect, and the fields of vision were normal. The patient used the right eye only for fixation, the degree of convergence of the left being about 30°; he could not fixate with the left; the convergence of the right eye therefore was not measured; from this time on improvement began to show itself, and on

March 21st the paralysis of the left eye had greatly diminished, and the eye could be moved 25° outwards beyond the median line; the right eye could not be brought beyond the median line. The ears were now examined for the first time with the mirror, and fractures were discovered in both osseous canals near the drums. In the left ear a line of fracture began at the upper margin of the drumhead, near the middle, ran backwards and outwards to the extent of about 8 *mm.* It appeared as a red line, was furrowed, and was very sensitive to the touch of a probe. The anterior portion of the drumhead was irregular and cicatricial, and had a small perforation (2–3 *mm* in diameter) near the margin. The posterior part of the drumhead was much thickened. The drumhead, handle of the malleus, triangular reflex of light of the right ear were normal, excepting a vertical linear scar in the anterior and upper part of the drumhead; it passed through the middle of the upper margin of the drumhead and was continued as a linear fracture upwards and backwards in the upper wall of the auditory canal for about 5 *mm.* It was similar to that of the left ear, though the separation was wider in the left ear. He heard the watch better with the right ear.

April 17th.—The improvement has continued. Each eye can now be abducted about 50°. The left is still turned far in (almost 30°), in consequence of the high degree of secondary con-

traction of the internal recti. The patient has the habit of turning the head toward the side instead of looking directly forward; this has been noticed since we began observing the case, and is due to the same cause. He is now rarely disturbed by the diplopia.

June 17th.—The external recti have recovered their function entirely, and the cornea of both eyes can be brought so far into the outer angle as to be covered 1 *mm*, or more. Still there is a moderate degree of strabismus. The diplopia, as measured upon Hirschberg's chart, is

12 degrees of homonymous diplopia in the median line.
8 " " " " at 20° to the right of the median line.
15 " " " " " " " " left " " " "

There is also a very slight difference in elevation, the false image (of the left eye) being 2° lower than the other in all parts of the field of fixation; but there is *no tilting* of the image. V, R E $\frac{8}{9}$ almost perfectly; V, L E $\frac{8}{12}$. (He tells me that the right eye was always the better.) The optic discs are normal. Accommodation of both eyes is good. The pupillary difference is still decided (diam. of right pupil, 3.5 *mm*; of left, 6 *mm*), but both pupils react to light and to accommodation.

July 1st.—His condition is the same. The lines of fracture in the auditory canals are still distinct. He claims to hear well, though not quite as well as before the accident; the right ear hears the watch at 80 *cm*, the left at 10 *cm*. The tuning-forks are heard better by aërial conduction (excepting the low C, which is heard better by bone-conduction in the left ear). The appearances described above justify us in attributing the impairment of hearing of the left ear to the changes in the middle ear, and in assuming that the nervous portion is uninjured.

July 15th.—The patient noticed a decided improvement in the facial anæsthesia, attended by tingling and burning in the cheek. The anæsthesia diminished considerably, but is still easily made out. Since then there has been no change (Aug. 17th).

In concluding this history, it should be mentioned that the mental condition of the patient was greatly disturbed after the accident; he has no recollection of the first week, during which he was sometimes delirious and often fancied himself at work. During the second week, he was very irritable and quarrelsome, tried to get out of his bed, and had suicidal impulses; his condition then became normal; during the whole course of the illness he did not complain of any pain.

Here then we have a case of fracture of the skull, as shown by the persistent bleeding from the ears and by the fissures seen in the auditory canals. The only paralyses noted were those of both abducentes and of the sensory portion of the right trigeminus, that of the two former having certainly been secondary; the paralysis of the left external rectus came on about the fifth day, that of the right about the end of the third week. In seeking the cause of these paralyses, attention must be directed to the temperature chart; there was a decided rise of temperature from the third day, reaching almost 103° on the eighth day, then falling and becoming normal about the twentieth day. This, we think, indicates an inflammatory reaction at the base of the skull, probably a circumscribed pachymeningitis.

We are of the opinion that there was a transverse fissure of the base of the skull, involving the petrous portion of both temporal bones. The fracture produced by a force acting transversely, as in our case, would of necessity (according to the rules of Wahl) be transverse. The line of fracture was probably of the kind described by Hartmann,[1] as "beginning at the apex of the petrous bone, going to the hiatus Fallopiæ and to the tegmen tympani." These fractures, "in general, follow the lines of union" of the primary bones that form the temporal bone. The line of fracture was just beneath, or near, the sixth pair as they enter the dura mater, and these became involved in the subsequent inflammatory exudation. The fracture likewise injured (directly or indirectly) the right Gasserian ganglion.

The paralysis of the left eye began to disappear about six weeks after the accident; that of the right external rectus lasted somewhat longer. Such a length of time might readily be consumed by the process of absorption of the inflammatory exudation.

The case is quite different from any of the cases collected by Purtscher, or the additional ones collected by us. It bears some similarity to Sachs's (Case 27 of Purtscher's list); but in the latter the paralysis was unilateral; it also came

[1] *Die Krankheiten des Ohres*, 4th edition, Berlin, 1889, p. 247.

on about the fifth day, and lasted several weeks; it was ascribed to a hemorrhagic effusion which, gradually sinking, produced compression of the abducens nerve. An inflammatory lesion was excluded, because there was no rise of temperature. In our case there was fever, and an inflammatory effusion is much more probable.

In certain respects our case bears resemblances to Church's case (Purtscher's list No. 36) and to Eaton's (our list No. 10), though both of these were primary and permanent paralyses. The lesion in the three was at about the same place, but while the nerve was compressed by an inflammatory effusion in ours, it was probably torn in the other two. In Church's case there was a difference in the size of the pupils, as in ours, and in Eaton's there was facial anæsthesia, but it was *bilateral.*

We have thus collected 11 cases, of which 7 were unilateral and 4 bilateral; added to those of Purtscher, we have 40 of the former and 17 of the latter. Six of the unilateral cases were primary (perhaps a 7th); of the bilateral cases, 2 were secondary and 1 (perhaps 2) was primary; 1 of the cases terminated in death.

Three of the primary cases recovered; (1 was due to basal compression, 1 to basal hemorrhage, 1 to nuclear hemorrhage); 4 were permanent (all basal).

The 2 secondary cases recovered. The termination of Ferri's case is not known to us.

There was a fracture of the skull in 6 of the unilateral cases (all basal), and in all of the bilateral cases; (in 2 it was basal, in 1 it involved the occipital, and in 1 the parieto-frontal region).

The lesion was probably basal in 4 (6) of the primary unilateral cases, nuclear in 2 (3). In the primary bilateral of Eaton the lesion was basal; in the 2 secondary cases it was nuclear once, basal once.

There was facial paralysis in 2 of our 11 cases; the trigeminus was affected 4 times, (once the motor branch alone, once the sensory paralysis was bilateral); there was crossed hemiplegia in 1 case, partial paralysis of the oculomotor in 1, and transient blindness in 1.

In several cases the early appearance of a high degree of secondary contraction of the antagonist, the internal rectus, is emphasized. Attention was directed to this fact by Purtscher.

Statistics have recently been published by Bloch[1] which are of interest in this connection. He collected all of the cases of ocular paralysis in Hirschberg's 116,000 cases. There were 1500 in all; of these 438 were paralyses of the abducens; of this number 32 were congenital and 406 acquired. Of the latter 21 were traumatic, all of these being unilateral. Ten of the traumatic cases could be subdivided as follows: orbital 3, basal 4, nuclear 1, intracranial 2. There was fracture of the base in 3 and an abscess in 1.

The frequency of paralysis of the abducens in fracture of the skull is shown by statistics compiled by Koehler.[2] During five years (from 1885 to 1889 incl.), there were 48 cases of fracture of the base and 49 of the roof of the skull treated in Bardeleben's wards at the Charité. Among this total number there was only 1 case of paralysis of the abducens, (the case mentioned in the footnote to Case 2), beside the case which we cited as Case 2 in our list, *i. e.*, 2 in 97. The facial nerve was affected *22 times* in this same number. In conclusion we cite the following from the same author: "The infrequency of injury (tearing, stretching, compression, etc.) of the abducens in cases of fracture of the skull is remarkable, for this nerve is exposed to such injuries, both in fractures of the base and in fractures of the roof of the skull (which latter send fissures into the base); for its course along the base is long, and it passes through a depression of the petrous bone, and this is frequently fractured" (Von Bergmann).

[1] *Statistisch-casuist. Beitrag zur Lehre v. d. Augenmuskellaehmungen*, Berlin.
[2] *Berlin. klin. Wochenschr.*, 1891, p. 433.

A CASE OF SCLERITIS; MICROSCOPIC EXAMINATION.[1]

By Dr. J. KOSTENITSCH, St. Petersburg.

Translated by Dr. Ward A. Holden.

(With Plate I., Vol. XXVIII., Germ. Ed.)

INFLAMMATION of the sclera, being a rare condition, has not often been microscopically examined.

Baumgarten[2] in 1876 described a case in which the sclera had reached the thickness of 4 *mm*, anteriorly. The external bundles of fibres were infiltrated with round cells, the accumulations being at some points so great as to resemble small abscesses. The conjunctiva and subconjunctival tissue were likewise infiltrated and the vessels dilated. The epithelium was unchanged. There was also a purulent infiltration of the ciliary body and choroid.

Alt, in his *Histology and Pathology of the Eye*, refers briefly to a case of purulent scleritis in which the layers of the sclera and the episcleral tissue were greatly infiltrated.

Uhthoff[3] later described the condition found in excised portions of episcleral and conjunctival tissue from cases of severe recurrent scleritis. The vessels of the conjunctiva were increased in number and dilated. In the sheaths of the vessels and about them were quantities of round cells, the intervening conjunctival tissue being normal or showing a more or less marked inflammatory infiltration. The lymph channels in the superficial layers of the conjunctiva were

[1] From the laboratory of Prof. Fuchs, in Vienna.
[2] *Arch. f. Ophth.*, xxii., 2, p. 185, 1876.
[3] *Arch. f. Ophth.*, xxix., 3, 167, 1883.

highly ectatic. In one case there were coagulated fibrinous and cellular plastic exudations and hemorrhages in the conjunctiva, indicating a hemorrhagic inflammation.

My case is as follows:

Miss S., æt. twenty-four, stated that the sight of her left eye had been lost twelve years before after measles. Both eyes have been inflamed at intervals for several weeks. The left eye is larger than the right, and sensitive to pressure, but with normal tension. The entire cornea is replaced by a white scar with a few vessels. Optico-ciliary neurotomy was done. The eye soon became painful again, and seven months later the patient requested enucleation. The corneal scar was sensitive. The adjacent sclera was blue at points and vascular. Below and to the nasal side was a large typical scleral nodule 10 x 6 *mm* in extent. Above and to the temporal side was a similar though flatter scleral nodule of bluish-red color. No perception of light.

A typical scleritis had developed in the previously blind eye, and the ball was enucleated, the conjunctiva over the scleral nodules being preserved with the specimen. The posterior pole of the ball was fixed by a cicatricial mass, beginning in the macular region and extending 15 *mm* inward beyond the region of the optic nerve. It was less extensive up and down. The internal rectus was adherent to the sclera by cicatricial tissue.

ANATOMICAL EXAMINATION.

1. *Macroscopic.*—The enucleated ball was hardened and divided by a meridional section. The optic disc was cupped, and the retina was thinner than usual. The anterior chamber was shallow, the iris atrophic and adherent to the cornea at its periphery. The scleral nodules could not be definitely located for the injection had disappeared.

2. *Microscopic.*—The vessels of the conjunctiva were increased in number and in size, and were filled with blood. In the conjunctival tissue of the outer portion of the eye there were a few isolated leucocytes near the vessels and some accumulations of round cells below. In that of the inner portion the infiltration was more marked, and anteriorly the mono-nuclear leucocytes were so closely packed that no other structure except vessels could be seen.

The lymph channels in the superficial layers of the conjunctiva were dilated and often contained granular masses. Some of the granules were sharply outlined and stained with hematoxylin, but not by the methods of Löffler and Gram. Here and there in the conjunctiva were small hemorrhages, probably caused by the enucleation.

The scleral vessels were everywhere increased in number and in size, and were for the most part filled with blood, particularly anteriorly. In the sections through the lower outer quadrant of the sclera, the leucocytes occupied all the layers of the sclera, and formed at various points small nodules and tracts.

The sclera in the inner portion of the eye was also infiltrated with round cells, which form nodules and tracts of some size (*St*, *Kt*, Jaf. I.).

At some points where the cellular infiltration was particularly well marked, there were foci of lighter color in which the leucocytes were polynuclear and the nuclei contained vacuoles. Here there were scattered chromatin crystals and small hemorrhages in which the red corpuscles had undergone changes, the whole representing a sort of necrosis of the cells infiltrating the tissue.

The fixed cells of the sclera were increased in number anteriorly, but the fibres showed no changes, being simply forced apart by the accumulations of leucocytes.

The corneal epithelium was cloudy, and contained leucocytes. The membrane of Descemet was nowhere recognizable. The corneal tissue was pervaded with vessels.

In the upper half of the eye there were many leucocytes near the corneal vessels, and in the lower half of the eye in all the corneal layers as well, and more numerous near the inferior margin. These corneal infiltrations were more or less directly continuous with the infiltrations of the sclera.

Descemet's membrane was partially detached and was not covered with endothelial cells. The anterior chamber contained a thick layer of new-formed tissue (Fig., *bd*).

The iris was atrophic and displaced forward, and was diffusely infiltrated with round cells with a few denser foci.

In the ciliary body the walls of the arteries were thick-

ened, and the tissue infiltrated with round cells. The choroid in its anterior portion was similarly affected.

The optic disc was cupped. The retina was atrophic. The fibrillæ of the vitreous were well marked, and among them were a few round cells (Fig., *gl*).

The lens was normal.

The presence of micro-organisms could not be demonstrated by the methods of Löffler or Gram.

The microscopic changes found may be divided into primary and secondary. Chief among the first are the inflammatory infiltrations of the ocular membranes. These infiltrations are particularly well marked in the periphery of the cornea, the sclera, and the conjunctiva of the inner half of the eye. In the outer side of the eye there are only scattered leucocytes in the neighborhood of the vessels. The iris and the ciliary body are much infiltrated in the portions corresponding to the excessive infiltration of the outer coat. The blood-vessels and lymph channels of the conjunctiva and sclera are dilated and increased in number.

Among the secondary changes are the cloudiness of the corneal epithelium, the absence of Bowman's membrane, and the detachment of Descemet's membrane; the presence of a layer of new-formed tissue in the anterior chamber and vitreous; the atrophy of the iris; the thickening of the walls of the arteries in the ciliary body and choroid; the atrophic degeneration of the retina; and the glaucomatous excavation of the disc.

The fresh inflammatory infiltration affected chiefly the middle layers of the sclera, and spread thence to the other layers and to the cornea, conjunctiva, iris, ciliary body, and vitreous. This observation corresponds to the clinical fact that deep scleritis is often complicated with keratitis, iritis, and cyclitis.

At some points there was necrosis of the exudation cells in the scleral nodules. This necrosis did not progress to the destruction of the entire tissue with the formation of ulcers or abscesses.

It may be assumed, however, that from the necrosis and later resorption of the cells, or from the prolonged pressure

of the exudation masses, the scleral fibres would be altered or destroyed, thus producing the thinning of the sclera that often follows deep scleritis.

Explanation of the Figure.

Lb. Dilated lymph channels.
Kt. Nodules of leucocytes.
St. Tracts of leucocytes.
gl. Fibrillæ of the vitreous and isolated leucocytes.
l. Leucocytic infiltration of the iris and ciliary body.
bd. A layer of new-formed tissue in the anterior chamber.
md. Membrane of Descemet.

ON THE CORNEAL SUTURE IN CATARACT EXTRACTION.

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Translated from the (unpublished) French original by H. KNAPP.

(*With two figures.*)

AFTER the long discussions which have filled the scientific publications of the last twenty years, an agreement on the best method of operating for cataract seems to have actually been reached. The great majority of operators have returned to the simple extraction, reserving the iridectomy for the cases complicated with adhesions or in which the iris refuses to take its normal position again. The partisans of the suppression of the iridectomy record from 8 to 12 per cent. of iris prolapse. These and plastic iritis are dreaded as the chief complications now, the purulent inflammations having fortunately become very rare.

The mechanism of the prolapse of the iris is still partially unexplained. Prolapse has occurred in cases in which the coaptation of the wound was perfect and the patient quite manageable. We are not yet able to foresee it. It always is for us the most disagreeable surprise and a grave danger for the future of the eye.

If we suppose that the prolapse of the iris is due to the sudden escape of an inordinate quantity of aqueous humor stowed up behind the iris by a rupture of the wound still too feebly cicatrized, we may think of two, apparently op-

posed, preventive measures, *i. e.*, either to cause a delay of the complete closure of the wound and the refilling of the anterior chamber until the cicatrix has become solid enough, or to suture the lips of the wound in order to secure a firm closure.

The first measure, proposed by Parinaud, necessitates the cutting of a flap which adapts itself badly. It has not, so far as I am aware, been much tried in practice.

The suture, on the contrary, gives an immediate and sure result. Henry W. Williams, of Boston, published in 1867[1] encouraging results. He had to use chloroform and applied his suture after the extraction when every pressure on the eye may be dangerous. Suarez de Mendoza, of Angers, has recently recommended the systematic use of the suture and insisted on the important point that it should be applied before the opening of the anterior chamber and possibly through the superficial layers of the cornea and sclerotic. (Congrès Français d'Ophtalmologie, 1889, 1891, 1892.) In his communication of 1892 he states to have used the suture thirty-eight times and to be very much satisfied with the results. He applies a single suture at the upper end of the vertical meridian. He begins with a shallow incision of the cornea, through the track of which the Graefe knife has to pass afterward, introduces the needle into the cornea two millimetres below his preliminary section, draws it out through the lower edge of the latter, reintroduces it through the upper edge, and brings it out 2 *mm* above it. The middle portion of the thread forms a loop which is placed on the side. It is evident that a narrow knife could pass in the ordinary way through the cornea without cutting the thread. After the extraction the suture is tied. The wound is perfectly closed and the anterior chamber re-established in two hours.

This is, in short, the procedure of Suarez. Without knowing it in its details I have, on my part, tried to suture the cornea quickly and safely.

I use very fine, short, sharp-pointed needles, and thin

[1] Compare these ARCHIVES, vol. I., p. 98.

but strong silk threads. The needles when armed are sterilized in hot air and kept for use in a sterilized paper envelope. After cocainization and disinfection I pass the needle through the cornea, in the vertical meridian, about 1 *mm* underneath the limbus; the point, without penetrating into the anterior chamber, emerges at the juncture of the opaque border, and the thread is drawn. Then the needle is introduced, about 1 *mm* above its point of exit, into the episcleral tissue, as is done in the muscular advancement. So soon as I find that the point has penetrated into resistant tissue, I draw it out again, in order to involve as little of this tissue as possible. As it is impossible to draw the needle out at right angles about 2 *mm* of conjunctiva are loaded on it, which is of no consequence. In drawing this thread I leave a loop, which is placed sideways toward the nose, and spread out carefully so as to avoid twisting.

The corneal section is made in the ordinary way, care being taken that the knife passes nicely through that portion of cornea which the suture has left free. Then I take off the speculum, and remove the cataract as usual. When the iris is well in position, an assistant holds the upper lid up, and I tie the thread.

It is to be borne in mind that I do not, like Suarez, make a superficial incision into the limbus corneæ, in the depth of which lie the points of entrance and exit of the thread, for this makes the corneal section with the narrow knife very difficult without cutting the thread in so narrow a passage. The coaptation in my procedure seems to me quite sufficient. Furthermore, I am not afraid to draw the knot tightly at the risk of folding the cornea. This folding disappears in a day, and the corneal astigmatism is neither increased nor diminished.

The suture does not inconvenience the patient. Rarely I remove it before the tenth day, when it has become quite loose. With one stroke of the scissors I cut off the knot, and seize the thread with forceps.

Accidents to Guard Against.—Involuntary cutting of the thread with the Graefe knife. This is rare. Generally a new needle can be passed through the hole of the old.

When the suture is tied, we should draw on the superior, scleral end of the thread. The coaptation takes place by itself. The opposite would be dangerous.

I can affirm that the suture infects the cornea in no way. The slight opalescence left in its track disappears quickly.

Operative Results.

I have practised systematically the corneal suture in 50 cases of simple extraction. In 45 the operation has been normal. The iris went back to its position, and the closure of the wound was perfect, without incarceration of the iris.

In 2 cases the reposition of the iris was laborious, and could not be maintained until the suture was tied anew. Nevertheless the result was excellent. Formerly I would have made an iridectomy.

In 1 case, a retrogressive cataract, prolapse of the vitreous ensued. When I had closed the suture, I was greatly surprised to see that the iris and vitreous had reduced themselves, and I have still been able to remove a few fragments of the lens.

In 2 cases of a normal operation I found, the next day, an angular incarceration of the iris. Thanks to the presence of the suture, the excision of the iris was very easy.

Thus, on the whole, there were 2 point-like hernias in 50 extractions, that is 4 per cent. I must say that without the suture I have never had less than 8 per cent. of hernia in 180 extractions I make a year. This proportion has even been raised in some series to 10–12 per cent., for inexplicable reasons. These figures are not extraordinary; they are

found in the statistics of excellent operators. Knapp, of New York, records 10 per cent. of prolapse in a recent series of 600 extractions. The frequency of this deplorable complication explains why many operators still cling to the combined extraction. The corneal suture gives, I believe, a satisfactory solution of this prolapse question, which has become a real nightmare. It is to be hoped that neither the spirit of routine, nor the fear of making the operation two or three minutes longer will prevent the new procedure from spreading.[1]

[1] The translator has had the good fortune to see some of the cases operated on by Dr. Kalt and to witness eight of his operations. The eyes operated on looked well, apart from some posterior synechiæ; seven of the operations passed without accident; in the eighth, prolapse of vitreous occurred. When the suture was united, the wound closed well, no vitreous protruded, the upper part of the iris was crowded toward the sclerotic, the pupil was irregularly enlarged, but its edge free in the anterior chamber.

The translator received a very good impression from this procedure, and it was at his sblicitation that Dr. Kalt wrote the above communication for the ARCHIVES, for which the editors express their thanks.

FURTHER ANATOMICAL AND CLINICAL CONTRIBUTIONS TO THE STUDY OF CENTRAL SCOTOMATA IN AFFECTIONS OF THE OPTIC NERVE.

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Translated by Dr. CASEY A. WOOD, of Chicago.

(With 3 drawings in the text, and figs. 1–4, Plates VIII. & IX., vol. xxvii. of German edition.)

IN a paper published in these ARCHIVES six years ago, I[1] (as well as Bunge[2]) demonstrated that the typical, laterally excentric, and oval scotoma, commonly found in toxic amblyopia and other diseases affecting the fibres of the papillo-macular bundle, presents certain peculiarities in every stage of its development. In this situation it is that the most delicate functions of the nerve of vision are first disturbed, while the centre of fixation itself may still remain normal; here, also, the disease reaches its maximum of intensity, and, finally, here it is that the last trace of the lesion and of its resulting scotoma can be traced, long after normal perception of form and color has been re-established at the central point. This nucleus which, from its geometrical shape and clinical importance, I have styled the "nuclear spot (Kernstelle) of the scotoma, lies horizontally, from 1°

[1] Sachs, "Anatomisch-klinischer Beitrag zur Kenntniss des Centralscotoms bei Sehnervenleiden." *Archiv f. Augenheilk.*, Bd. xviii., page 42. These ARCHIVES, xviii., p. 133.

[2] Bunge, *Ueber Gesichtsfeld und Faserverlauf im optischen Leitungs-Apparat*, Halle, 1884, pp. 9 and 10.

to 8° in a lateral direction from the fixation point, its breadth, vertically, being mostly below the horizontal line. Unless the diseased process extends still farther, or while it is in its first stages, the limits of the "nuclear spot" do not extend either to the fixation point or to the blind spot. In the latter event the typical oval shape is reached. It is at the "nuclear spot" that a small absolute scotoma may form, and in the same situation it longest persists while the amblyopia is undergoing cure.

I now present the following case with an account of the autopsy and remarks thereon.

CASE 3.—K. L., æt. nineteen, student, was admitted to Prof. Schnabel's eye clinic January 1, 1884. Father died in battle; mother living and healthy. Two brothers, aged twelve and nineteen, died of "lung disease." During the winter of 1882–83 he was attacked by tearing and stabbing pains in the chest, extending to the clavicles. For a year these were accompanied by a feeling of oppression and palpitation of the heart, which often kept him from school.

The disturbance of vision for which the patient sought advice had set in a month previously, had got appreciably worse within a fortnight, and he had not been able to read for a week. "Everything swims and is cloudy before the eyes; in the distance human faces appear black." Along with this defect of vision there were loss of appetite, a feeling of weakness, dryness in his mouth, great thirst, trembling of the hands, and, after a week, insomnia and loss of memory. He denied abuse of tobacco and alcohol.

Present condition. Very pale, tall, overgrown man; coated tongue with acetone breath. Examination of lungs shows infiltration of the right apex. Slight evening rise of temperature. Urine slightly diminished in quantity, dark yellow-brown color, containing a small amount of albumin, but never any sugar. Both eyes normal externally. Fundus changes same on both sides: large physiological excavation extending almost to lateral borders of the nerve head; marked capillary hyperæmia of the papilla, with faint, radiating streaks of cloudiness in the neighboring retina. The retinal veins are somewhat broader than normal. V R = fingers at 2 *m*, excentrically below. V L = fingers at 3 *m*, somewhat better below. Peripheral F of V normal on both sides.

Scotomata for all colors on both sides.

R E, RED: *above* 13°, *above-out* 13°, *out* 13°, *out-below* 10°, *below* 6°, *below-in* 6, *in* 6°, *above-in* 7°; (in the scotoma patient calls it "gray").

GREEN: *a* 10°, *a o* 15°, *o* 13°, *o b* 9°, *b* 5°, *b i* 5°, *i* 5°, *a i* 5°; in the scotoma, "gray."

BLUE: *a* 12°, *a o* 9°, *o* 15°, *o b* 9°, *b* 7°, *b i* 7°, *i* 4°, *a i* 7°; in the scotoma, "whitish."

YELLOW: *a* 5°, *a o* 10°, *o* 15°, *o b* 7°, *b* 4°, *b i* 2°, *i* 2°, *a i* 2°; medially from the centre "yellowish," otherwise "white."

Left eye. RED: *a* 7°, *a i* 5°, *i* 5°, *b i* 4°, *b* 5°, *o b* 10°, *o* 13°, *a o* 12°; "gray."

GREEN: *a* 8°, *a i* 4°, *i* 5°, *b i* 4°, *b* 4°, *o b* 8°, *o* 12°, *a o* 8°: "grayish white."

BLUE: *a* 5°, *a i* 3°, *i* 5°, *b i* 2°, *b* 4°, *o b* 7°, *o* 12°, *a o* 9°; "whitish."

YELLOW: *a* 5°, *a i* 2°, *i* 2°, *b i* 2°, *b* 3°, *o b* 5°, *o* 13°, *a o* 7°; "yellowish" towards centre, otherwise "grayish."

Treatment. Rest in bed, nourishing food, Carlsbad salts.

January 8th. V R = 1/18 and J. xii.; V L = 1/12 and J. vii. Less urinary deposit, but still some albumin.

Jan. 15th.—Scotoma for red, right eye; *a* 12°, *o* 13°, *b* 5°, *i* 5°; "green" or "gray.".

Green: *a* 5°, *o* 9°, *b* 4°, *i* 3°; "gray."

Left eye. Red: *a* 4°, *i* 7°, *b* 5°, *o* 13°; "gray."

Jan. 18th.—The lateral walls of the physiological pit in both papillæ show a gray-greenish discoloration. The hyperæmia of the rest of the nerve-head has disappeared, as has also the slight œdema of the nervous layer of the retina.

The general condition, particularly the appetite, is better; evening temperature 38.0° C., or a few tenths higher.

Jan. 21st.—Discoloration of the lateral walls of both papillæ more marked. Potass. iodid. grm. 1.0 daily.

Jan. 26th.—V R = $\frac{1}{12}$; *Schweigger* 100 at 10 *cm.* V L = $\frac{1}{6}$; *Sch.* 90 at 12 *cm.*

Scotomata, R Red: *a* 7°, *o* 13°, *b* 4°, *i* 3°; centrally and medially in the scotoma this color was called "dull red," immediately to one side from the centre "gray."

Green: *a* 7°, *o* 17°, *b* 4°, *i* 2°; "gray."

Left. Red: *a* 8°, *i* 3°, *b* 8°, *o* 13°; "gray." Green: *a* 6°, *i* 5°,

b 3°, *o* 13°; "grayish yellow." *Fundus*, right eye; the large retinal arteries somewhat smaller; left, doubtful.

General condition not so good; appetite gone; coughing and chest pains worse. Patient so weak that he can with difficulty sit up. Burning in soles of the feet; darting pains in the joints of the lower extremities without objective signs.

Evening temperature higher, nearly 39.0° C. Stopped K. I.

Feb. 1st.—Visual acuity much improved. V R = $\frac{3}{18}$. *Schw.* 80 at 11 *cm.* V L = $\frac{3}{12}$ and *Schw.* 60 at 12 *cm.*

Feb. 6th.—K. Br. 2.0 daily.

Feb. 9th.—General condition continues unsatisfactory.

Feb. 10th.—V R = $\frac{3}{18}$; *Schw.* 60 at 9 *cm.* V L = $\frac{3}{9}$; *Schw.* 40 at 15 *cm.*

F of V. Scotoma, Right eye. Red: *a* 7°, *o* 17°, *b* 5°, *i* 5°. Green is laterally from the centre "somewhat worse," but there is no marked scotoma. Left eye. Red: *a* 5°, *i* 5°, *b* 5°, *o* 13°. Green same as red.

A year later (7/2/85) an examination shows a remarkable improvement in the eye signs.

Fundi. On both sides there is a well developed grayish discoloration of the lateral sides of the papilla.

V R and L = $\frac{6}{9}$; binocular V = $\frac{6}{6}$. J, 1 with each eye, at 30 *cm.* Color test with Daae's chart gives correct results for either eye.

The blind spot extends horizontally from 13°–17°.

The scotomata on both sides have moved from the centre to one side.

Right eye. Red: *a* 7°, *a o* 2°–13°, *o* 1°–9°, *b o* 1°–8°, *b* 5°. In the centre red is very little affected, but is seen as "green" in the horizontal meridian within the limits indicated. Above and below it is interpreted as "green," "yellowish," and "yellowish-red." There is no scotoma for green.

Left eye. Red: *a* 5°, *b* 5°, *b o* 2°–12°, *o u t* 1°–13°, *o a* 2°–10°; called "gray" in the region of the scotoma.

Green becomes yellow in the horizontal meridian between 2°–12°.

Soon after these last examinations the patient grew worse of his lung disorder, and died April 7, 1885. The autopsy showed no disease whatever of the brain, but the lungs were filled with tubercular deposits.

The eyeballs, with the chiasma and tract. optic. attached, were preserved in Müller's fluid and afterwards hardened in alcohol.

The right optic nerve, including its intraocular end, was imbedded in celloidin and most of it cut into an uninterrupted series of cross-sections. The posterior half of the nerve within the canal was divided into longitudinal sections, as was, also, the whole of the left nerve. The clinical conditions being almost identical in the two eyes, and since some aspect of the nerve changes might better be studied in the light of two kinds of sections, it was thought best to vary them in this way. The chiasma and tractus were cut in frontal planes. Unfortunately I have not a complete series of sections. Owing to an accident I have lost portions of the left nerve, of the intracranial portions of both nerves, and of the posterior portion of the chiasma itself. The result of this study will show that the loss of preparations of the left part of the nerve within the canal is chiefly felt.

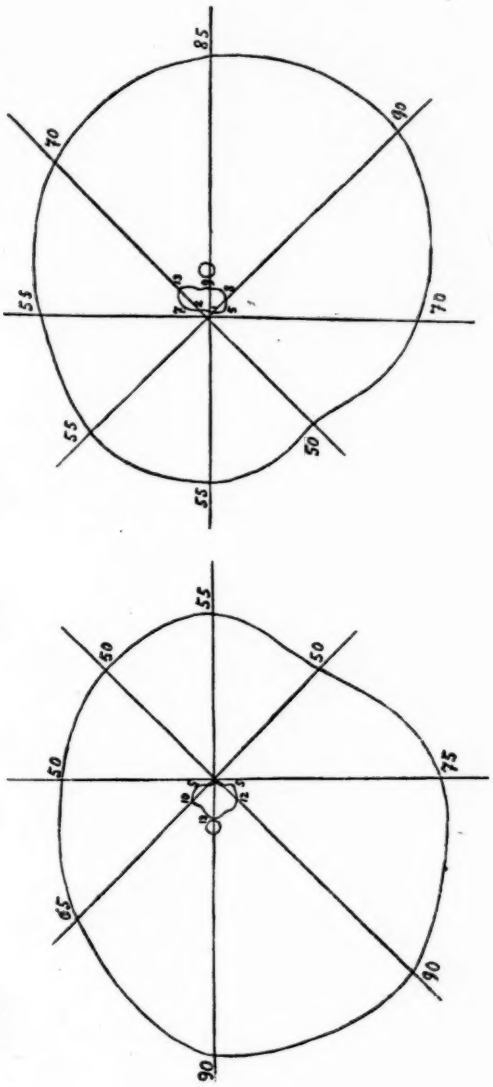
The sections were stained by a method mostly my own, in preference to that of Weigert-Flesch.

For the purpose of outlining the atrophic area and defining the alterations within it, use was made of a weak magnifying power, the result of which I shall now proceed to give.

Right Nerve.—Immediately behind the lamina (Fig. 1, Plate VIII.–IX.) the atrophic area presents the form of a concavo-convex meniscus. Where it occupies a lateral position with reference to the central blood-vessels it is most narrow. Above and below it becomes broader, the larger portion belonging to the lower half of the nerve. Although the convexity of the meniscus does not touch the pial sheath on all sides, inasmuch as the upper and lower ends are somewhat removed from it, yet about one fourth of the periphery of the diseased area is so disposed. The *concavity* is turned towards the central vessels and connecting both runs a broad band (see Fig. 1 of the plate) of hypertrophied connective tissue interlaced with a triple row of almost normal bundles. This normal band of tissue is interrupted in one place only, above and to one side of the vessels, where a well-marked diseased bundle lies. Following a horizontal line outwards from the vessels we find its peripheral termination of almost the normal dark color, its centre yet more darkly illuminated, while on its borders, alongside of larger patches, are isolated areas of fibres still unaffected. Below and above (especially above) the centre of this radius the nerve bundles are most decidedly atrophied. At the radial line, and running in both directions, are some bundles containing medullary fibres that now and then reach to the upper

FIGS. 1 AND 2.

VISUAL FIELDS.



and lower end of the meniscus. The peripheral bundles at the end of this radius that border upon the nerve sheath are, as just mentioned, better preserved, but are much more deeply affected than those at the upper and lower pole of the atrophic area.

The cross-section is plainly shown to be sloping from without, in its horizontal diameter measuring 2.5 *mm*, its vertical 3.25 *mm*.

A short distance behind, that portion of the convexity of the meniscus next the sheath diminishes in size ; the normal bundles first below, later above, turn in and consequently the curve of the atrophic bow is increased. Still farther back the blood-vessels, previously lying in a lateral position, approach more the axis of the nerve and leave the concavity of the meniscus and are separated from the latter by a larger number of normal nerve-bundles. In this way the relative position of the two vessels and atrophic area remains the same.

The separation of the diseased bundles from the nerve sheath now proceeds so rapidly that at the point of entrance of the vessels (about 15 *mm* behind the eyeball) only about two bundles touch it at the extremity of the horizontal radius.

The central vessels (the artery nearer the bulb than the vein) run in the lower-inner quadrant of the nerve substance and they barely touch the diseased area in crossing it.

The atrophied area now increases in height and decreases in width, and the curve of the contour turned towards the nerve axis becomes less. Its measurements in this situation are : vertical 3 *mm ;* horizontal somewhat less.

Just on this side of the point of entrance of the vessels the inner boundary line has become almost straight or at least very slightly curved, and the point of contact between the convex border and the sheath lies above.

Farther back towards the apex of the orbit the atrophic area occupies a lower position, and the breadth of the circumjacent ring of normal nerve-bundles is smallest outwards and downwards, *i. e.*, at the entrance of the canalis opticus the diseased spot is four times farther removed from the inner-upper periphery than it is from the corresponding outer-lower line. (See Fig. 2, Plate VIII.–IX.),

In this transverse section the ophthalmic artery appears laterally in the posterior orbital part of the nerve, then runs more outwards aud downwards, and finally reaches, in the neighborhood of the bony canal, the lower and peripheral portion of the opticus.

At about the entrance of the vessels there appears a well defined concentration of the bundles within the atrophic area, thus making a more pronounced picture of the degenerated medullary fibres than appears anywhere else in the nerve until it enters the eyeball. This new arrangement of the bundles remains about the same until just before the orbital opening of the canalis opticus is reached. A description of the parts in this latter locality is desirable, inasmuch as it is here that the inflammatory changes to be later spoken of, as well as the atrophy of the medullary tissue in the bundles above referred to, reaches its greatest intensity. The whole area of atrophy, as before mentioned, lies close to the lower-outer periphery of the nerve, and presents to it a convex border, while its median outline, an almost straight line, runs almost parallel to the vertical diameter of the transverse section. It presents in this situation the shape of an upright half-oval (Fig. 2). At the medial border in an almost vertical line lie some atrophic bundles, and, affected to about the same degree, are others at the upper and lower poles of the diseased area. The atrophy is more pronounced still on the lateral convex boundary, except in a small and similarly placed median group of bundles which are distinguished from their neighbors by the larger amount of medullary tissue which they contain (see Fig. 2, p. 481). The most marked atrophic patch is seen in a group of five or six bundles which lies almost in the centre of the area of degeneration. This group (*K* in Fig. 2), which I shall designate as the "nuclear group" (Kerngruppe), is sharply defined and shows macroscopically as a bright spot in the Weigert preparation. The arrangement of the diseased bundles about the nuclear group is to this extent symmetrical that the vertical radii are somewhat longer than those that cross them at right angles. At the medial margin in the lower half and towards the centre of the nerve are some bundles which are almost normal (Fig 2, *F*.) The measurements of the area just described are 3.25 *mm* vertically, horizontally 2.8 *mm*.

In the distal half of the canal the atrophic patch is found to be nearer the lower periphery of the opticus, and does not lie in such a lateral position as before. The long diameter of the patch is no longer vertical, but leans obliquely, and finally is disposed horizontally in the middle of the canal. The half-oval form of the diseased area partly disappears and develops at its superior and inferior (later on, owing to its rotation, its inner and outer) poles, pointed projections. When the long diameter of the

atrophied focus has become horizontal, the nerve has assumed the form of an oblique oval. In the middle of the canal the horizontal diameter measures 3.5 *mm*, the vertical 2.8 *mm*.

Left Nerve.—The Weigert preparations of the horizontal sections in general show the groups of atrophic bundles as a bright band that, in the non-vascular and posterior orbital part, occupies about a third (1 : 2.7) of the breadth of the whole nerve, and is separated from its inferior-lateral border by a small strand of dark-stained tissue. After the entrance of the vessels the atrophic band is separated both from the former and from the lateral border of the nerve by intact bundles. Its breadth is about a fourth that of the nerve proper.

Towards the eyeball the strand of normal bundles at the external border becomes continually narrower, and just behind the bulb the atrophic band reaches the border itself. In the same way the dark line (of normal nerve bundles) interspersed between the vessels and the atrophic area becomes indistinct as it approaches the eyeball. The color of the diseased band, where the incompletely atrophied bundles lie, is gray; the middle portion of the band in the posterior orbital part is distinguished by its bright coloration, just like the nuclear group in the cross-section of the right nerve.

The situation of the papilla can be made out by a low power as a funnel-shaped excavation, separated by a thin and ill-defined tissue wall from the scleral border.

Immediately before the chiasma (in the dorsal region and occupying most of its upper circumference) there lies in each opticus a bright spindle-shaped spot, with its long axis placed horizontally and measuring 4.25 *mm*. Beneath the lateral pole of the (about 1 *mm* broad) spindle, and separated from it by a narrow strand of normal tissue, is a much smaller depôt, whose longest diameter is directed obliquely downwards and inwards.

In the most forward section of the chiasma the arrangement is still more peculiar; the bilateral atrophic bands are separated from one another by a rather broad tract of medullated fibres. Gradually, however, the dorsal spindles approach the middle line, while the normal band of cross fibres correspondingly decreases.

Still farther back the separation of the lower-lateral from the dorsal deposit becomes less distinct, the dorsal tracts look longer in an oblique direction and shorter in their vertical dimensions, and between them run whitish atrophic cross-fibres, which are easily distinguished from the deeper parts of the diseased por-

tions towards the middle line. In the posterior half of the chiasma the atrophic areas again separate and become (obliquely) shorter. The horizontal diameter measures in the centre of the chiasma 14 *mm*, the height of the lateral halves being 3.5 *mm*.

Optic Tracts.—The sections of the tracts appear like apple seeds whose points are directed towards the base of the brain. The atrophic area presents exactly the same form, extent, and position in the sections, which include the parts of the optic tracts to the point where they cross the crura cerebri. It follows closely the contour of each tract, beginning as a cone-shaped body at the base of the brain, turning its rounded extremity forwards, inclosed below and in by a broad (externally by a thinner) mantle of normal medullary fibres. The superior extremity shows a complete section of Meynert's commissure. Below, towards the entirely normal portion of the section, the atrophic patch is not well defined.

Horizontally each tract measures 3.44 *mm*, vertically, 4.5 *mm*.

MICROSCOPICAL EXAMINATION OF THE FINER ALTERATIONS.

Right Nerve. Intraocular Portion.—A more or less pronounced atrophy of all the axis-cylinder bundles in the neighborhood of the diseased area can be made out in the scleral sections of the nerve. This is not very pronounced in those bundles immediately about and to one side of the central vessels, but is plainest in those that form a part of the most degenerated medullary nerve fibres. The corresponding trabeculæ of the lamina cribrosa seem pressed together, so that the openings in the latter membrane appear narrower than normal, and yet to contain but a small amount of their usual axis-cylinder contents. Still within the scleral portion of the nerve the most atrophic bundles are seen in a band that stretches horizontally from the vessels. Upwards and downwards from this band the laminar openings become gradually larger, and the axis-cylinders within them become broader and more numerous.

In the choroidal region the boundary line separating the more from the less atrophied bundles is less sharp than before. In those most affected the nuclei of the neuroglia are closer together —evidently increased in number.

The retinal portion of the papilla appears in the sections as a ring, broad vertically but narrower in the lateral diameter, owing to the site of the physiological excavation, that measures 0.75 *mm*

(over 1½ d. diams.) at its widest part. The diseased fibres lie entirely at the external border and occupy about one fourth of the circumference of the papillary pit. Here, instead of the usual number of properly arranged and comparatively wide axis-cylinders, separated from one another by regular rows of nuclei, we see only a thin layer of narrowed fibres whose interstices are so filled with abnormally large collections of glia cells that the cellular elements can hardly be distinguished from the surrounding fibres.

The nerve layer of the *retina* is markedly atrophied, and its ganglion cells are smaller and in part without processes. In the macular region, on the other hand, the ganglionic cells are well developed.

The extra-ocular portion of the nerve close to the ball contains no bundles entirely without medullary matter. The medullary fibres there have decreased in proportion to the extent of the atrophy and are displaced by homogeneous masses that the Weigert fluid has stained a yellowish color. The unaffected bundles are scattered in larger or smaller groups over the atrophic patch. The glial nuclei are neither here, nor before the vessels enter the nerve, absolutely increased in number, but approaching nearer one another lose more and more their normal curvilinear arrangement, as the individual bundles decrease in size. In the neighborhood of the eyeball the connective-tissue septa are slightly broader, but some millimeters behind the lamina the areolar hypertrophy is well marked. It is also very pronounced in the axial connective tissue, decreasing toward the apex of the orbit. In spite of this areolar hypertrophy the nuclei are not to any extent increased numerically and in no situation is there any cellular infiltration. On the other hand the coarser connective-tissue spaces in the anterior portion of the orbital section present a remarkable and conspicuous collection of capillaries crowded with blood. In the axial connective tissue, also, are isolated hemorrhages.

In the nerve bundles behind the entrance of the vessels the normal fibres are reduced to a minimum, but there are none without medullary tissue. Where the atrophy is most marked the cellular elements within the bundles of the "nuclear group" show a decided numerical hypertrophy. This is most apparent in the parts nearest the orbital apex, where numerous large cells form a continuous layer on the outer surface of the affected nerve-bundles. These cells interlace the bundles like a net whose narrow meshes are filled with a collection of atrophic or partially incomplete medullated fibres. The cells are so crowded that they often,

owing to the pressure, assume a flattened, polygonal shape of the epithelial type. These bodies, usually large and filled with protoplasm, now appear, in the glycerine preparation, to be full of fine granules. The protoplasm of many of them contains medullary remains which, stained by the Weigert process, present a bluish-gray appearance (fatty metamorphosis).

The structural alterations affecting the areolar septa do not by any means correspond with the cellular proliferation within the bundles of nerve fibres. At the orbital opening of the canalis opticus, in one of two very pronounced atrophic bundles of the diseased "nuclear group," (separated from each other by an areolar band), is seen a cross-section of a large vein (see *V p.* in Fig. 3, Plates VIII.–IX.). The adventitia both of this larger vessel and of such branches of it as are exposed in the section are so infiltrated with cells that their location can be made out with the naked eye, owing to the intensity of the blue hemotoxylin stain. The vein rapidly decreases in size as it runs forward from the apex of the orbit, but as long as it is visible the periphlebitis may be seen. On the other hand, neither inflammatory infiltration nor perivascular changes can be discovered in the optic canal itself; there appears to be a decrease in all of the pathological changes that marked the "nuclear group."

Some of the horizontal sections in the posterior part of the canal reveal evidences of extensive vascular changes and of interference with blood circulation resulting from them. To one side and below, between the pial sheath and the outer nerve bundles, is seen the oblique section of a vein (*V p.* of Fig. 4, Plates VIII.–IX.). which approaches in size the *vena centralis antica.* The lumen of this vessel is partly occupied by blood corpuscles, while the rest of it is blocked by a proliferation of the endothelial cells. A branch of the vein stretching towards the axis of the nerve, but not exactly at right angles to it, has been converted into a cellular cord (Fig. 4, *V th*) from whose sides arise fine, almost capillary (neoplastic), vessels (*v, v*) filled with blood. From these, minute extravasations have, here and there, taken place.

Left Nerve.—The minute alterations in the papilla and retina closely resemble those of the right optic nerve. The changes in the extra-ocular portion differ in amount and intensity and situation, but at the same time bear a general resemblance to those of the right nerve.

In the chiasma and the tracts the diseased area presents all the marks of a simple atrophy.

Although the patient was evidently not a drunkard, he probably smoked. In any event, the history of the case, the course of the disease, the results of treatment, as well as the pathological changes, all point to a true toxic amblyopia.

Among 6953 private patients I have seen 97 cases of toxic amblyopia (1.39 per cent.), and experience has so modified my previous belief that I now think that tobacco plays the most important part in the causation of the disease. I agree with Horner[1] that in persons so affected the amblyopia is almost always associated with dyspepsia. In those who both smoke and drink, the alcohol contributes its influence toward the production of the disease mainly by inducing a chronic gastric catarrh, or at least by interfering with the digestion and assimilation of the food. In this way it indirectly assists the injurious action of the nicotine (or some other of the tobacco derivatives) to produce the optic-nerve disease. Horner goes still further. He believes that neither tobacco nor alcohol, *as such*, is a cause of the amblyopia; they are of consequence only as a producer of gastric catarrh, of a general weakness of the whole organism. However, the rarity of retrobulbar neuritis in chronic dyspepsia, tuberculosis, carcinoma, and similar affections, apart from tobacco, and its infrequence in women form a strong argument against Horner's extreme views.

Although in the 97 cases referred to I found 4 women affected by toxic amblyopia, these all smoked *and* drank. I have not seen a case where the woman used alcohol alone. The experience of Uhthoff (138 cases) and Branchli is the same. Groenouw saw 2 women (in 185 cases) with "pure alcoholic amblyopia," but the symptoms pointed rather to an axial neuritis, *i. e.*, the central scotomata were not typical of toxic amblyopia.

The explanation of the action of tobacco in producing the usual disturbances of toxic amblyopia, in the presence of stomachic catarrh, I seek in certain complex chemical combinations occurring chiefly in the stomach, and probably resulting from the transformation of the normal gastric

[1] "Ueber Intoxications-Amblyopie." *Correspondenzbl. für Schweizer Aerzte*, 1873, No. 13.

juices into acids of the fatty type, whose compounds with nicotine are either more readily absorbed, or are with greater difficulty eliminated from the system, than the simple tobacco bases themselves.

The evidence of abnormal chemical changes occurring in the stomach is plain enough from the acetone odor emitted from the mouth of such patients. In the same way diabetics, addicted to the abuse of tobacco, have butyric acid in their urine.

It is said that while alcohol is known to produce changes (peripheral neuritis, atrophy, paralysis, etc.) in other portions of the nervous system, these effects have never been shown to result from the abuse of tobacco. The answer to this objection is the clinical evidence (on the side of tobacco as affecting the opticus), the rarity of pure alcoholic amblyopia, and the fact that the changes in the nervous system set up by alcohol elsewhere are entirely unlike those found in the optic nerve. In the mixed cases when the ocular apparatus is affected in pure alcoholics the *eye muscles* and not the optic nerve are most likely to suffer.

Of the greatest importance is the atrophic deposit at the orbital termination of the optic canal, where the tissue alterations were most pronounced, and whence, doubtless, the pathological process spread to other parts of the nerve.

Looking at the following diagram (Fig. 3), the scotoma-bundle assumes the shape of an ellipse bisected in its greater axis, the latter being parallel to the vertical diameter of the nerve.

FIG. 3.

F and F_1, fibres of the lateral halves of fovea and macula. *K*, "nuclear group." P_2, parapapillary fibres.

The small letters indicate the position of the peripheral fibres supplied to the various quadrants of the visual field; *aoo* and *aoa*, fibres for the outer-upper quadrants; *aua* and *auu*, for the outer-lower quadrants; *ioo* and *ioi*, for the inner-upper quadrants; *iui* and *iuu*, for the inner-lower quadrants.

The convex outline of the atrophic area approaches the lower-outer margin of the opticus. At the lower two-thirds of the ellipse is a small band (F), whose connection with the former is marked by a slight decrease in the amount of medullated fibres which it possesses. The atrophic area represented in Fig. 3 corresponds closely in form and position with the functional defects of the visual field. The scotoma bundles, just like the scotoma in the field of vision, lie in a lateral position from the vertical diameter. In the same way there was a portion of the field outside of the vertical diameter where the color sense for red was to some extent altered. This corresponds to the bundles on the medial border of the atrophic area. The groups of bundles, marked F and F_1, are the fibres for the medial half of the centre of the field.

Thus, at the distal termination of the canalis opticus the foveal fibres are disposed almost exactly in the axis of the nerve; the fibres of the lateral half of the macula lie medially, and those of the medial half of the macula laterally, from the centre of the cross-sections. In no respect does the nerve axis correspond with the fibres of the scotoma-bundles most affected by the disease—the laterally decentred "nuclear group."

In other words the arrangement of the degenerated bundles about the axis of the nerve corresponds entirely to the asymmetry shown by the perimetric examination.

In spite of the fact that their function remained almost intact the bundles corresponding to the external lateral half of the papilla appeared with the ophthalmoscope to be discolored a grayish green. This discolored sector measures not 180° but about 120°, and affects *not* the macular fibres but those that supply and terminate in the retinal area between the papilla and the macula so that the term "pallor of the lateral half of the papilla" is often incorrect. Moreover we thus have an explanation of Uhthoff's cases of "pallor of the disc without visual disturbances," where *paracentral* and not central bundles have been affected.

The disease which begins in the "nuclear group" successively attacks portions of the nerve about it until the papillo-macular bundles are affected, but the morbid process does not reach such a high degree in the latter, and thus it is

easy to understand why an absolute defect is never found centrally, and why the disease in this region is usually reparable. The alterations do not affect the nerve fibres themselves but merely the areolar septa, in the form of hyperæmia and œdema, so that the true nervous tissue enclosed by the former is merely temporarily injured. Thus the curability of a recent amblyopia may be looked for with certainty.

The more minute alterations of the intraocular termination of the optic nerve are responsible for the well-known "discoloration of the lateral half of the papilla." The physical explanation of this condition has not hitherto been sufficiently dwelt upon. Gowers considers it as due to a disappearance (atrophy) of the capillary vessels and a reduction of the red element in the normal color of the disc.

Of more importance and easier of demonstration is the influence of the atrophy on the coloration of the papilla. The contraction of the areolar spaces of the lamina cribrosa, the marked aggregation of their trabeculæ in consequence of a diminution in size of the nerve bundles that pass between them must increase the quantity of light reflected from the anterior surface of the lamina itself. Moreover, the thinning of the *overlying* nervous layers contributes largely to the same result. This phenomenon is really a "contrast" effect, the remaining area of the papilla being either of the normal reddish color or made still redder by a hyperæmic condition often present.

The histological changes seen in sections of the nerve trunk on both sides of the point of entrance of the retinal vessels differ from those found in the latter region, in that in the former the hypertrophied connective tissue is unaccompanied by cell proliferation, while at the vascular entrance the alterations presented inflammatory changes within some of the bundles and about some of the vessels.

Samelsohn has pointed out the resemblance between retrobulbar neuritis and cirrhosis of the liver; in both affections the diseased process affects the interstitial connective tissue, and in both the essential tissues of the organ (nerve fibres and hepatic cells) suffer secondarily from pressure upon

them. The analogy may, I think, be carried still farther. The areolar hyperplasia and cellular infiltration, characteristic of the interstitial hepatitis, do not bear any constant relation to one another, and are not dependent upon one another. In the same way as shown in the microscopical examination of my patient's optic nerves, the areolar hypertrophy and the cell proliferation appear to be entirely independent of each other, the latter being generally conspicuous by its absence. Nor do I believe that a widespread cellular infiltration could have preceded the connective tissue hypertrophy without showing unmistakable evidence of its existence, when one recollects that the optic-nerve disease lasted (until the death of the patient) only a year and a quarter.

The remarkable increase in the number of the neuroglia cells within the diseased bundles is also noticed by Samelsohn.

If one accepts the latest theory of the epithelial origin of the neuroglia[1] it would not be improper to compare this process with the commonly observed proliferation of epithelium within the bile ducts. At any rate one effect of this tissue change is to compress and injure the nerve-fibre bundles themselves.

The parallel between hepatic cirrhosis and neuritis interstitialis is still more striking when the vascular changes in our case are noted. These frequently occur in the first mentioned affection, and consist of endothelial proliferation resulting in thrombotic closure of some vessels, occurring side by side with new vascular formations.

Vossius[2] discovered at the beginning of the canalis opticus, and following the axis of the nerve, a vein which left the latter "on its lower surface just where the ophthalmic artery crosses the dural sheath." This vessel is called the *vena centralis postica* by Kuhnt, and Vossius found its position in the nerve as well as its point of exit therefrom to be entirely constant. If we return to our microscopical prep-

[1] Edinger: *Zwölf Vorlesungen ueber den Bau der nervösen Centralorgane*, 1892, p. 31.
[2] Vossius: *Archiv f. Ophthal.*, Bd. xxix., 4, p. 142.

arations and compare the position of that small vein, whose cross-section immediately in front of the canalis opticus shows a decided round-cell infiltration, we must conclude that it corresponds exactly in position to the vena contralis postica. *Not only, then, do these sections of the right nerve amply prove the occurrence of vascular changes in the diseased tissues, but the position of these changes points conclusively to the vena centralis postica as the site of the morbid alterations.* These are not only a proliferating endophlebitis, leading to connective-tissue obstruction of the vascular lumen, but a periphlebitis resulting, first in a choking of the peripheral capillaries and afterwards in small extravasations from them. New vascular channels also appear in the neighborhood of the obstructed vessels, and these, becoming overcharged with blood, are again the seat of small hemorrhages.

It is not probable that these alterations in the vena centralis postica constitute the *usual* explanation of the isolated affection of the papillo-macular bundle. Of one thing I feel assured, and that is *the advisability of paying special attention, in future investigations of this kind, to the condition of the posterior central veins, and, when possible, of studying them in injected specimens.*

Explanation of the Figures of Plates VIII. and IX.

FIG. 1.—Cross-section of the right optic nerve immediately behind the eyeball. Weigert preparation. Zeiss, Obj. A, Oc. 1.

Vc, Central vessels. *K*, "Nuclear group." *Fb.* and *lmb*, Nerve-fibre bundle for the fovea and the lateral half of the macula. *Pp*, Parapapillary bundle.

FIG. 2.—Transverse section of the nerve at the apex of the orbit. Weigert preparation. Zeiss, Obj. A, Oc. 1.

F F^1, Fibres distributed to the lateral half of the fovea and macula. *K*, "Nuclear group." *Pp*, Parapapillary bundle.

FIG. 3.—Portion of a cross-section through the optic nerve at the apex of the orbit. Hæmatoxylin preparation. Zeiss, Obj. D, Oc. 1.

K, Bundle from the "nuclear group" very rich in cells. *Vp*; Lumen of the vena centralis postica showing perivascular connective tissue, infiltrated by small cells.

FIG. 4.—Portion of a longitudinal section through the posterior half of the right nerve lying within the canalis opticus. Hæmatoxylin-glycerin preparation. Hartnack, Obj. 4, Oc. 2.

Vp, Vena centralis postica. *V th*, Continuation of this vein. obstructed by areolar tissue. *V V*, New capillary formations in the neighborhood of this thrombosed vessel. *Rp* and *Rd*, Principal proximal and distal branches surrounded by hemorrhages. *R d*^{1}, a distal branch filled with blood. *hgcfl*, Coalescent hemorrhage in the ramification-territory of the chief proximal branch. *V th*, Small twig obliterated by hypertrophied connective tissue.

REPORT OF A CASE OF THROMBO-PHLEBITIS OF THE CENTRAL RETINAL VESSELS, WITH NECROPSY.

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(*With six figures in the text.*)

THE following case of thrombosis and phlebitis, occurring in an organ where the course could be observed from beginning to end, throws light on one of the processes of inflammation which is elsewhere veiled from vision in opaque tissue and cannot be so well studied although it is relatively common in other places. The ophthalmoscopic and microscopic views that I am enabled to present give an additional interest to the report.

C. W., male, æt. eight; from a farming community; was referred to me January 19, 1893, by Dr. G. A. Ritchie, of Manawa, Wis., with the history of sudden blindness occurring in left eye four days before. Family history negative. Previous health good although never robust. About January 1st, two weeks before onset of blindness, he had an attack of mumps of moderate severity, but at the time of examination had apparently made a complete recovery.

Status Præsens.—Healthy in appearance. Heart normal; no evidence of valvular lesion. Kidneys and urine normal. All functions appear to be properly performed. Eyes: R E normal; vision, $\frac{6}{vi}$. L E, vision, o. Pupil slightly dilated; no reaction to even strong light. Associated movements to light and accommodation normal.

Interest centered chiefly in the ophthalmoscopic examination which revealed complete closure of the central veins of the retina with beginning vasculitis and perivasculitis (see Fig. 1). The optic disk and surrounding retina were apparently filled with suffused blood. Isolated hemorrhages of a flame-like character following the direction of the nerve fibres

FIG. 1.
Thrombosis of Central Vessels.

and striated whitish lines could also be observed. The borders of the disk were slightly blurred, merging into the surrounding retina, the upper portion being covered by a large hemorrhage. By a hurried examination the condition might have been taken for that of neuro-retinitis, although this was readily excluded by finding upon focussing that there

was no prominence of the disk, by the appearance of the neighboring vessels and macula, and by the existing blindness of sudden onset. The arteries were much constricted and at the borders of the disk were lost to view, showing beyond as narrow reddish streaks with loss of the characteristic vessel reflex. The veins were much dilated and tortuous, in some places of a peculiar sausage-like appearance and filled with blackish-red coagulated blood. Both arteries and veins were obscured in places by hemorrhages and at other points were covered by opaque retinal tissue. The macula presented a striking appearance of œdema. There was an irregularly star-shaped spot at the fovea, dark red at its centre, which within a few days underwent changes in form thus showing it to be true hemorrhage, and a number of radiating hemorrhages at the edges of the macula lutea, lighter in color than those at other portions of the fundus.

The red spot at the fovea with the characteristic œdema of the macula seemed to indicate embolism; this diagnosis would be borne out by the history of sudden and complete blindness occurring without pain and without premonition in a previously well eye. But patients' statements as regards vision are unreliable, and if there had been a blood clot in the trunk of the central artery the arterial circulation would have been cut off in some of the arterial branches, which condition did not exist until several days after the first examination. The spot at the macula was a true hemorrhage. In embolism the cherry-red spot is due to contrast of the choroid with the whitish œdema of that part of the retina immediately surrounding the macula. Two typical cases of embolism of the central artery coming under observation about the same time permitted of critical comparison. The characteristic hemorrhages into the nerve and retinal tissue, the complete stasis of the venous circulation, the peculiar sausage-like appearance of the veins left no doubt that we had here a case of thrombosis, the starting-point of which was an active phlebitis of the central veins. This may have come on as a result of some morbid condition of the vessel walls so often found in the infectious diseases but seen oftenest in other parts of the body.

The case remained under my personal observation at this time for about a week. Large doses of kali iodid. were given in connection with tonics. He was then returned to the care of the family physician with directions for same treatment. Repeated careful examinations failed to discover any cardiac lesion or other abnormality of vital organs. The

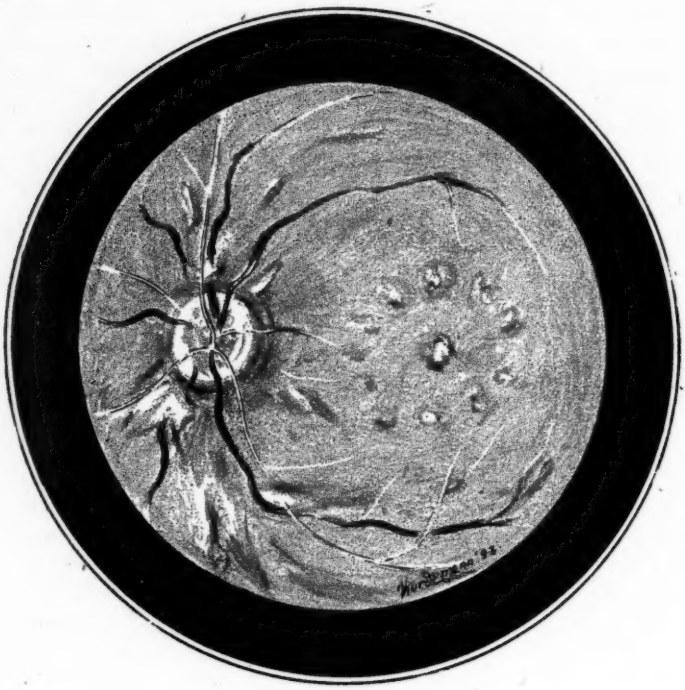

FIG. 2.
Atrophy of Nerve and Retina with Beginning Connective-Tissue Formation.

above treatment was continued for one month when he was again sent to me for examination. The right eye as before was found normal. In the left the pupil was slightly dilated, responding but feebly to strong light; associated movements normal.

The ophthalmoscopic appearances were radically different (see Fig. 2).

The whole fundus was lighter in color and the sites of the various hemorrhages could be faintly distinguished as patches of grayish-white discoloration. The optic nerve appeared slightly cupped, white and atrophied. The location of the principal arteries could be seen as whitish streaks. At the disk the vessel walls could be faintly seen. Portions of the principal veins seemed to be of normal size but in places were filled with unabsorbed clotted blood. In other portions the vessels were obscured by discolored grayish patches with yellowish centers, evidences of previous hemorrhages. The position of the fovea was occupied by a whitish spot, the edges of which were pigmented. At the periphery of the macula whitish-yellow spots were observed. The œdema had evidently passed away; the veins still contained some clotted blood; the arterial system was empty, and the hemorrhages were in process of resolution. The ophthalmoscopic picture was that of a transition stage; but I do not think that at a later period it would vary greatly although we would find the nerve whiter and more cupped, the vessels more completely obliterated, and further evidences of connective-tissue hyperplasia in opaque lines about the retina.

Hardly expecting to see the case again, nearly a year later (Jan. 3, 1894), a letter was received from his family physician, stating that the boy had several inflammatory attacks in the affected eye, increasing in frequency and severity during the last two months, necessitating the administration of morphia for relief of the intense pain. In a subsequent letter it was learned that the eyeball became as hard as stone during the attacks, and that the tension was at all times greater than that of the other side. Eserin was ordered, but the glaucomatous process was not controlled by the drug, for he had two painful attacks in two weeks, each lasting about twenty-four hours. He was brought to my office on the day following one of these painful periods with indubitable signs of acute glaucoma. Vision L E, nil; tension plus 2; pupil dilated; anterior chamber

practically obliterated; cornea steamy, with a rosy-red ring of congestion about the limbus.

Ophthalmoscopic examination showed a connective-tissue formation in the vitreous near the posterior surface of the lens, and clearly visible by oblique illumination, looking very like a detached retina with narrow bands extending into other portions of the vitreous. Near the posterior lenticular surface a broad band was stretched from above downward obscuring the view of the optic disk and other parts of the fundus (see Fig. 3).

FIG. 3.
Membranous Opacity in Vitreous.

The peripheral portions of the fundus were much lighter in color than normal and no vessels would be recognized on several painstaking examinations made by my colleague and myself. From the miserable condition of the child by reason of constant dull pain, and being convinced that the glaucomatous attacks would recur at more frequent intervals in an organ the function of which was permanently lost, it was deemed best to enucleate the eye, which was done on Jan. 16, 1894, at the Wisconsin General Hospital, chloroform anæsthesia, Dr. J. S. Barnes assisting. Patient made an uninterrupted recovery, being in good health since the time of operation and in possession of excellent vision in the other eye.

Necropsy.—After removal the eyeball was placed in Müller's fluid for six weeks and then frozen in ice and salt, divided through the centre of the nerve and cornea, one

half being mounted in gelatin in a glass jar and reserved as a macroscopic specimen, while a number of sections were kept for microscopic examination from the other half. The thanks of the author are due to Dr. H. B. Hitz for material assistance in this portion of the work.

Examination of Macroscopic Specimen.—Eyeball of normal size; cornea apparently thin; sclerotic normal; lens normal but pressed forward, making the anterior chamber shallow; the latter clear; iris adherent at lower periphery, and posterior chamber small; a large sheet of connective tissue in the vitreous, extending from the retina at lower segment, with small strands of tissue. In the half reserved for this specimen the retina was considerably detached in the lower portion, but this is believed to have occurred during the necessary manipulation in mounting the specimens. The choroid coat was likewise detached in places from the sclerotic and retina. The nerve is smaller than normal, and is not cupped, although the microscopic preparations show this condition (see Fig. 4).

FIG. 4.

Vertical Section through Eyeball.

Examination of the Microscopic Specimens.—These were submitted to double staining in hæmatoxylin and picric acid, and mounted in balsam. Cornea, lens, and sclera apparently normal. Iris agglutinated in lower portion to anterior capsule of lens by fibrinous deposit. The ciliary region showed marked hyperplasia of connective-tissue, the canal of Schlemm being difficult of recognition. Connective-tissue strands were found free in the vitreous and extending

from the retinal surface. The retina and choroid showed connective tissue degeneration. In the region of the macula, presumably in the site of some of the old hemorrhages, the granular layer of the retina contained red blood corpuscles, which were undergoing granular and fatty degeneration.

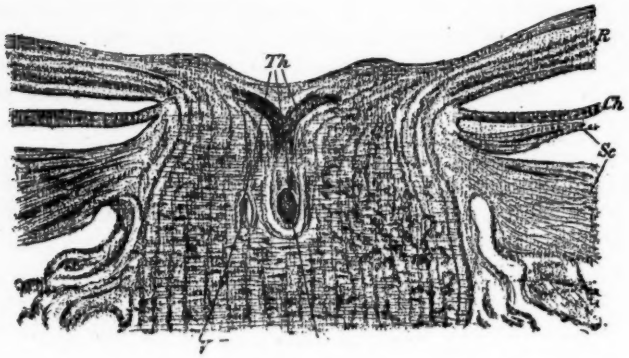

FIG. 5.

Section through Optic-Nerve Entrance. (Enlarged about 50 diam.) Showing occluded artery *(A)* and vein *(V)*. *Th*, Thrombus; *R*, Retina; *Ch*, Choroid; *Sc*, Sclera.

Most interesting was the condition of the optic nerve, in which the sections (see Figs. 5, 6) showed clearly the antecedent process of phlebitis and thrombosis, with the resultant perivasculitis and consecutive atrophic changes. There was marked increase in the interstitial ramifying connective tissue, and particularly the covering of the separate nerve bundles. The nerve fibres were becoming medullary and growing varicose. The walls of the perivascular spaces were very thick, and these, with the lymph spaces around the separate nerve bundles, were occluded. The artery was completely occluded by a granular mass of degenerated white and red blood corpuscles, contained in a fibrinous clot, one millimetre from the lamina cribrosa and extending for about five millimetres. The vein also held a clot, but only in places, where it could be traced in isolated patches of fibrinous exudation in which a few blood corpuscles were

enmeshed, clinging to the walls of the vessel. There was marked thickening of the adventitia of both vessels, and in every instance the intima was intact, showing that there had been no hemorrhage into the nerve tissue. No good section of the retina could be obtained in the neighborhood of the blood-vessels (in the peripheral portions), but it is certain that there were grave changes in the vessel coats of this structure. Many sections of different portions of the eye were prepared for microscopic examination. In all the membrana limitans externa was apparently intact. This negative finding does not greatly oppose the supposition that in places this membrane was ruptured, as it is believed that the beginning of the extensive connective tissue formations in the vitreous arose from hemorrhages of the retinal vessels into that body.

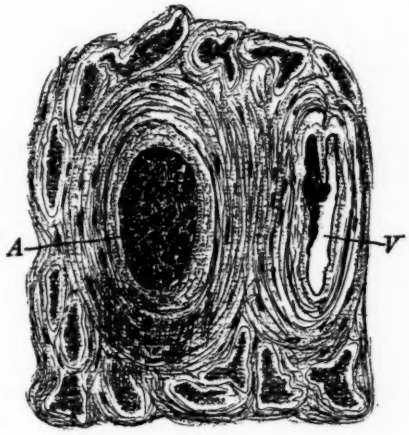

FIG. 6.

Portion of Fig. 5. (Enlarged about 320 diam.) Showing thrombus completely filling lumen of artery *(A)* and small clot in vein *(V)*.

An opportunity for continuous observation of such a rare case is seldom given. It was seen from within a few days of the onset, through its various stages of phlebitis, extension of the inflammatory process by continuity to the arteries, resulting in vasculitis and perivasculitis, with

stoppage of the circulation and subsequent obliteration of the vessels, with degeneration and loss of function of the structures cut off from their blood supply. Following on this there was proliferation of connective tissue, formation of membranous bands in the vitreous and fibroid degeneration of the various structures, resulting in occlusion of the lymphatic channels and glaucoma.

REPORT OF THE PROCEEDINGS OF THE EIGHTH INTERNATIONAL CONGRESS, HELD AT EDINBURGH, AUG. 7 TO 11, 1894.

By Dr. NIEDEN.

On the 7th of August the ophthalmologists assembled at Edinburgh—not to be sure in as great numbers as had been expected in consideration of the fact that this, the one beautiful capital of the north had been their unanimous choice six years before as the place for this year's International Ophthalmological Congress.

Even allowing that the Congress held at Rome in the spring of this year had taken away many of those who would otherwise have participated, and that the unfavorable state of the weather deterred many from so distant a journey, it was still remarkable that of the 290 members who had announced their intention of taking part only 167 actually put in an appearance, and that London, of all places, had a particularly scanty representation. Fortunately, however, this limitation in the number of those assembled had no ill effect upon the success of the whole affair. On the contrary, the Edinburgh Congress both in what it offered from a scientific standpoint, and also in its external form, and the entire manner in which it was conducted and in which its programme was carried out, ranks as a worthy second to its predecessor in Heidelberg.

Dr. Argyll Robertson was upon nomination by the General Secretary, Dr. Berry, elected President of the Congress. He accepted his election with thanks, and in his speech of welcome pointed out the significance to the medical world of their assembling place, Edinburgh ; he paid in warm terms a tribute to the memory of our great master Donders, who conducted the last Congress, and to that of Becker, his energetic assistant, in that work ; coupled with this his heartfelt wishes for the speedy

recovery of von Helmholtz, Donders's fellow-worker in founding ophthalmological science, who at that moment was lying ill; and wished the Congress a vigorous development and prosperity.

Dr. Power (London) and Swanzy (Dublin) were nominated and unanimously elected Vice-Presidents. The following were named as Honorary Presidents: Drs. Panas, Meyer, and Landolt (France); Zehender, Leber (Germany); Hansen Grut (Denmark); Raymond (Italy); Snellen (Holland); Roosa and Knapp (America); Critchett, Priestley Smith, Little, Pridgin Teale, and Read (Great Britain). Dr. Berry (Edinburgh) was elected General Secretary, and Drs. Parent (France), Hess (Germany), and Fergus (England) Secretaries.

After a welcome by the Lord Provost of Edinburgh to those assembled and his election by them as honorary member of the Congress, the proceedings were begun and the following spoke:

1. SNELLEN (Utrecht) upon the *subconjunctival method of treating operations and traumatic wounds of the cornea and sclera.* He believed that the greatest stress should be laid upon the value of closing the wounds as speedily and securely as possible, and that this can be effected in (1) the cataract-operation by making a broad conjunctival flap; in (2) the squint-operation by covering the wound with the conjunctiva that has been detached; in (3) the operation for glaucoma by first passing the knife forward beneath the scleral conjunctiva and then subsequently opening the anterior chamber. When there is general sclerosis and in buphthalmia of children numerous small paracenteses near the margin of the cornea are found advantageous. In the case of scleral wounds, too, care should be taken to cover them as far as can be with conjunctival flaps, as in this way the chance of an infection of the wound is reduced to the lowest possible limit.

2. KNAPP (New York) presented a *report of observations upon six hundred operations for cataract,* of which 52 (8.6 %) were made with iridectomy and in 49 gave a good result. In the 548 operations performed without iridectomy, prolapse, incarceration, or adhesion of the iris occurred in 55 cases (10.3 %). In 14 cases the prolapse had to be excised, while the final result was good in 49 cases (in 7 V = $\frac{8}{10}$) and fair in 2. In 2 cases there was loss of one eye, in 2 loss of both (general rheumatic cachexia). In 403 (66 %) of the 600 extractions the secondary cataract was operated upon by means of the knife-needle, and with the exception of 8 or 10 cases, considerable improvement of the

vision and a permanent good result were obtained in this way, while in only one case was the eye lost from glaucoma. The operation for secondary cataract in this form may be characterized as devoid of danger, since the acute glaucoma which is sometimes associated with it can be relieved either by myotics, iridectomy, or even by paracentesis. Among the 12 cases of glaucoma which occurred in the 403 secondary operations (3 %), a cure was produced in 4 with eserine and in 7 by means of iridectomy.

The discussion by Little, Panas, Swanzy, Noyes, Critchett, and M. Teale was carried on in the most lively fashion with respect to the much debated theme of the relative advantages of extraction with and without iridectomy, inasmuch as the number of opponents and of champions of either procedure was about equal, until finally Hansen Grut concluded the debate and summed up the matter in brief by saying that, as it is known that every practitioner of experience considers his own method of extraction the best in every case, such a one would derive no benefit whatever from a prolonged discussion, while a younger colleague would only be confused and rendered uncertain by such a conflict of views. Snellen laid down as the underlying principle of his treatment that every case must be treated in accordance with its own special characteristics, that every prolapse of the iris should be excised without any attempt being made to reduce it, but that with a large section, full anæsthetization of the eye, disuse of the speculum, and the employment of eserine, it is possible in the majority of cases to operate without iridectomy. The operation for the secondary cataract is performed in fourteen days, on an average, after the extraction.

3. Priestley Smith (Birmingham) spoke of *scleral puncture as an adjunct to iridectomy in glaucoma;* believing that in cases in which special difficulty is caused by the protrusion of the iris or lens against the posterior surface of the cornea, more favorable conditions both for the reduction of the intra-ocular tension in general and also for the subsequent performance of the iridectomy are secured by means of a scleral puncture made with a Graefe knife at a distance of at least 5 *mm* from the margin of the cornea. Smith had done the operation fifty times without once experiencing any bad consequences from the occurrence of bleeding, etc., while the results are better now than formerly.

Abadie, Parent, Pflüger, M. Hardy, Power, and Menachs confirmed the advantage of this operative procedure when undertaken

with a view to the subsequent performance of an iridectomy, while the two speakers first named declared that sclerotomy alone had no curative power in glaucoma.

4. LEBER (Heidelberg) had observed with regard to *injuries of the eye by foreign bodies composed of copper and brass*, that in the majority of cases the latter were aseptic. Nevertheless, in every case in which the foreign body is extracted, test-cultures should be made from the latter. If, then, a growth of micro-organisms occurs, enucleation ought to be performed, since it is almost exclusively by microbes that the danger of a sympathetic involvement of the other eye is produced. In cases in which there is asepsis, healing usually occurs quickly, and conservative measures may be adopted, and particularly so as long as the functions of the retina remain good. Among 46 cases observed Leber had never seen sympathetic ophthalmia. He went into details in the discussion of the subject, and as to the method of operative procedure in the various situations that the foreign body may have in the eye, including, frequently, cases in which the corpus delicti can be found and extracted only after a pretty extensive division of the vitreous. Of 38 cases which were operated upon, 20 were attended with a good result and 18 were not ; while in 8 cases he had to desist from operative procedure of any kind.

The discussion (Knapp, Roosa, Noyes, Kipp, Meyer) brought out additional testimony tending to prove that foreign bodies of copper had remained sometimes for years in the eye and had then been spontaneously extruded at the orifice of entry (in Meyer's case ten years afterward).

5. PANAS (Paris) treated the theme of *paralyses of the ocular muscles after lateral compression of the skull* and enunciated the facts as follows: (1) The majority of the cases are produced by fracture of the base of the skull. (2) The absence of fracture of the vertex by no means excludes fractures of the base. (3) The sixth pair of cerebral nerves, being the one that runs the greatest distance through bony canals, is the one that is most injured. (4) The injury to the nerves is due either to the fracture itself or to extravasation of blood into the brain. In the former case the paralysis follows at once upon the injury, in the latter case not till an interval of some extent. In the discussion Chibret participated with some observations bearing upon the subject.

6. MULES (Bourdon) spoke of a *new thread operation for the treatment of ptosis*, in which a small elliptical portion of the cart-

ilage is removed and then the border of the lid is connected in the usual way with the frontalis muscle by a cicatricial band.

7. He also spoke of *securing immediate healing of corneal ulcers* by covering the ulcerated surface with an antiseptic gelatine lamella prepared with boric acid and iodoform, and applying a pressure bandage for several days. Noyes advised the application of pure carbolic acid to the separate foci of infiltration, as being usually accompanied by good results.

8. PFLÜGER (Bern) pled for *drainage of the eye* by means of a small cruciform piece of gutta-percha, sharpened at the end, and inserted into the anterior chamber at the margin of the cornea, and believed that he had seen good results from this in severe infection, keratoconus, detachment of the retina, and glaucoma. Instead of this procedure, Walker advised that, in order to secure a permanent fistula into the anterior chamber, a conjunctival flap be introduced into the latter and made to unite there by its apex, so that in this way a continuous slight oozing of the aqueous should be produced.

On the second day of session and those following it, demonstrations of anatomical preparations and drawings were made during the first hour, at which every speaker was allowed to deliver a short discourse without any discussion being allowed after it.

9. DIMMER (Vienna) showed preparations of *retinitis albuminurica*, in speaking of which he called attention to the fact that where the conditions are the most unfavorable for the nutrition of the membrane, *i.e.*, in the region of the macula and the external molecular layer, there also the degenerative processes have their greatest extent and intensity.

10. JULER (London), reasoning from preparations which he presented, argued in favor of the existence of a *dilatator pupillæ*, which, arising from the ligamentum pectinatum, is situated in the posterior layer of the iris, and consists of true muscular fibres.

11. FRANKE (Hamburg) exhibited extremely instructive photographs which made clear the *histological processes in the healing of perforating wounds of the sclera*, and in which were very beautifully seen the processes characterized by Grawitz as "serving for the awakening of dormant cells." The microscopical examination was considerably facilitated by the fact that the longitudinal, transverse, and oblique bundles of the membrane could be seen very well in the same section. The transformation

of the cells in the sclera was complete only at the margins of the wound, the cells in the body of the latter being converted into cicatricial tissue.

12. DE LAPERSONNE (Lille) demonstrated microscopical preparations of an *orbital cyst with a microphthalmic eyeball*, the walls of which were formed of a perfectly developed but completely degenerated retina. Enclosed in the centre was found the lens.

13. MANN (Edinburgh) had undertaken the task, laborious, it is true, and yet one for which he might feel well repaid by the reception it encountered—the task, that is, of demonstrating upon microscopical preparations by means of the projection-camera *the change produced in the cells of the central organ of sight and their nuclei by the action of light.* From this demonstration it appeared that first the nuclei enlarged and then both nuclei and cells showed impairment of the staining of their chromatin. If, however, the action of the light was kept up for more than fifteen minutes, it produced shrivelling of the nuclei. This holds good both for the ordinary cells of the sympathetic plexus of nerves and also for the motor cells of the brain and cord and the nerve-cells of the optical apparatus, especially those in the ganglion-layer of theretina.

14. DARIER (Paris) showed the *aseptic collyria* prepared cording to his design, and also an *aseptic case* for dressings, of the familiar kind, and a *skiascope* of new construction.

15. Then ABADIE (Paris) spoke upon *chorio-retinitis*, stating that the seriousness of the lesion depends upon the participation of the intra-ocular end of the optic nerve in the pathological process, and that from this circumstance the prognosis is to be estimated as favorable or bad, and the treatment is to be fixed upon. In the matter of symptoms good color-sensation, especially for green, is to be regarded as an evidence of the distinctly favorable character of the affection of the optic nerve. Hereditary syphilis is doubtless one of the most powerful factors in favoring the development of chorioiditis. A. considered the best method of treatment to be subcutaneous injections of sublimate, etc., to which, in very chronic and rebellious forms, are added sub-conjunctival injections of sublimate (1–2 drops of a 1 % solution). As regards the exhibition of potassium iodide, an absolutely unfavorable judgment was pronounced.

In the discussion Deutschmann pointed out the weakness of

the proof adduced by the speaker, and said that he believed that while full recognition should be given to the advantages of sub-conjunctival injections of sublimate, the treatment with potassium iodide must be allowed at least a part of the claim to which it has been held entitled. So too Panas.

16. GUNN (London) spoke of the *changes at the macula in conjunction with inflammation and œdema of the retina*, changes which in chorio-retinitis, anæmia, thrombosis of the retinal arteries, etc., present themselves to ophthalmoscopic observation under the familiar form of lines or radially disposed folds, and which persist after the subsidence of the evidences of inflammation. Thompson and Noyes took part in the discussion.

17. BENSON (Dublin) presented a case of *recurring temporal blindness* in an individual who previously had suffered only from malaria and rheumatism, and who for four years past had been subject to attacks of either total or partial obscuration of the outer half of each visual field. Ophthalmoscopically no change was discoverable beyond a slight veiling of the outlines of the papilla and of the macula in the left eye. But during the attack, which lasted from two to five minutes, the affected portion of the retina appeared almost perfectly bloodless. Other subjective disturbances were absent, nor was there any lesion of the heart or kidneys. Without doubt there was present here a condition of spasm of the vascular walls either affecting all branches or but a single branch of the central artery; for the brevity of the attacks admitted of no other explanation. Noyes, Thompson, and Nieden reported similar observations.

18. DUFOUR (Lausanne) had observed in several (eight) cases *profuse hæmorrhage from the retrochorioidal vessels in connection with operations upon the eye*, including one case occurring after an iridectomy for glaucoma, which had consequently to be followed at once by an enucleation. There is no diagnostic means which enables us to predict the possibility of the occurrence of such a hæmorrhage. Hæmostatic agents, cold, and the pressure bandage are of no avail against the hæmorrhage. D. had, however, seen arrest of the bleeding produced by a large dose of morphine injected without delay in the temporal region, and in this way has been able partially to preserve the eyeball. He therefore advised that, in order to be secure against any contingency, a solution of morphine of the proper strength to produce nausea should be kept on hand, so as always to be ready for use in operations. Ayres,

Gruening, and Power reported similar experiences. Darier proposed using apomorphine.

19. TSCHERNING (Paris) spoke in regard to the *mechanism of accommodation*, showing that he had determined experimentally that the increase of refraction produced during accommodation changes towards the periphery, so that the accommodation, at a distance of 2.5 *mm* from the axis, amounts to only one half of that at the centre. A change in the shape of the lens can be produced in animals by traction made upon the zonula, and, moreover, the structure of the ciliary muscle makes it seem probable that such a traction actually takes place. Chibret confirmed these experiments.

20. VIAN (Toulon) had in three cases seen good results in the *treatment of diphtheria of the eye by means of crude petroleum*, the surface of the conjunctiva being bathed with the latter every two hours. The cornea is not injuriously affected by this treatment; on the contrary, in case infiltration exists, the latter promptly clears up.

21. BULL (Paris) had continued his studies upon the *effect produced by the pressure of the lids upon the cornea*, studies which he had begun some years previously in his work upon monocular asymmetrical diplopia; and he had become more and more convinced of the importance of this factor in producing definite forms of asthenopia, which he calls tarsal. This asthenopia appears frequently under the guise of rapidly developing exhaustion upon reading, and especially upon reading in bed.

Savage combated this view, while Swan M. Burnett said that he had often seen irregular astigmatism and evident changes in the corneal curvature produced by pressure of the lids. So also Power and Roosa.

22. MENACHO (Barcelona) reported a case of *optic neuritis following catarrhal amygdalitis* in a young girl who two weeks afterward became totally blind from a bilateral neuritis and remained so until two days afterward, when the sight was restored by excision of the tonsils, and within a month had returned to normal. He considered the causal connection, which could only occur by reflex action through the glosso-pharyngeal and sympathetic, as both possible and probable.

On the third day of session:

23. LEBER showed the new hardening agent *formol*, which is particularly suited for anatomical preparations made for the eye,

and possesses great advantages over Müller's fluid. It produces hardening of the tissues by coagulation, without dehydrating them, and does it too in a very short time without causing shrinking, so that it is possible to make sections after an immersion of only twenty-four hours in a 10 per cent. solution. It is a particularly valuable feature that both the natural color and the transparency of the parts are preserved; the cornea and lens are but slightly clouded, and the vitreous remains perfectly transparent. The process of embedding in celloidin is simplified, since the necessity of washing out the hardening fluid is done away with. The preparations are equally well adapted for microscopic examination and for treatment with stains. The price of the material, obtained from Meister, Lucius, & Brüning in Höchst, is 6 marks a kilogram.

24. BACH (Würzburg) gave a report upon *experimental investigations upon the variety of ulcer produced by staphylococci* and its treatment, showing the complete inefficacy of subconjunctival injections of sublimate, since in the first place, if the ulcer is not a perforating one, no cocci at all get into the eye, and in the second place no traces of sublimate can be demonstrated to exist in the ocular fluids after the injection. The hypopyon is produced only by inflammation of the iris and ciliary body. The galvanocautery appears to be the only rational method of treatment.

25. The same speaker further said that he had observed that the *minute structure of the ganglion-cells of the retina* is not of a fibrous but of a granular nature. The granules become continuous with dendrites, not with axis-cylinder processes. It is precisely in this region that the pathological changes first appear in morbid processes in the retina.

26. GUTMANN (Berlin) had made investigations with regard to the nature of Schlemm's canal, and had found Schwalbe's view of the communication between the anterior chamber and Schlemm's canal to be correct. The canal should be known as the sinus venosus scleræ.

27. CLARK, C. F. (Ohio) made a demonstration of two serous cysts of the iris, one of congenital origin from a child two years old, the other, originating without discoverable traumatic causes, from a woman thirty-two years of age.

28. LANDOLT (Paris) defined his views upon the squint-operation by affirming that *advancement* of a muscle is much preferable to tenotomy, since by the latter the range of excursion of a mus-

cle is very considerably limited, while the former may be said to plunge the eye deeper into its muscular apparatus and thus increases its "unrolling range." Advancement exerts a particularly favorable effect in motor insufficiencies, and advancement of two homonymous muscles produces the best result in medium degrees of strabismus convergens, and does not afford any danger of producing an over-correction ; nor can it cause a disfigurement of the eye through recession of the caruncle. It is only in high degrees of squint that tenotomy of the antagonists is done in addition to the advancement ; and even in this case care must be taken to perform it as a subconjunctival operation and without extensive detachment of the muscle from the surrounding tissue.

The discussion in this case, as in the question of the cataract-operation with or without iridectomy, turned in the most lively fashion upon the subjective views of the individual speakers (*e. g.* Swanzy, Gruening, Panas, Roosa, Stevens, Noyes).

29. CHIBRET (Clermont-Ferrand) made the following statements with respect to the relative value of *mercury and potassium iodide* in the treatment of *syphilis* of the eye : mercury alone is always successful, potassium iodide alone never. The severe forms of syphilis can be treated only with mercury, either alone or in combination with potassium iodide. In many cases of oculo-cerebral disease it appeared that a distinct deterioration set in after the employment of potassium iodide, while injections of sublimate even in a short time gave excellent results. The change to potassium iodide should be made only when salivation and symptoms of poisoning make their appearance. The most suitable preparation for injection is a 0.5 % solution of mercurous cyanide in water and glycerin with a slight addition of cocaine. One centigram is a sufficient dose, given at first once a day, and after a period of from 4 to 9 days three times a week. Diarrhœa is to be carefully looked out for and treated.

30. DARIER (Paris) also expressed himself with great emphasis upon the advantages of *subcutaneous injections of mercurous cyanide*, once or twice a day. The insoluble salts ought to be used only when a proof of a tolerance of the substance has already been afforded by the employment of a certain quantity of mercury. Intra-ocular injections are indicated in severe disorders of the vitreous, deep traumatic disease, advanced sympathetic inflammation, and severe syphilitic affections which have not yielded to general (subcutaneous) and subconjunctival injection. The chief

indications for subconjunctival injections are: (1) as being the most powerful and most promptly acting antiseptic in traumatic and operative infection, and also in infectious keratitis with or without hypopyon; (2) the presence of a torpid, parenchymatous keratitis, diseases of the chorioid, and plastic iritis, in case there is no marked venous stasis; (3) as an antisyphilitic. The principal contra-indication consists in a venous stasis of the circumcorneal vessels, as in this case absorption takes place very slowly, and the injections produce an irritation which is more violent than dangerous.

In the discussion the views in regard to the usefulness of these injections were very much divided. Hess, as the result of his experiments, was unable to see in a single case any but the very slightest effect upon the form of ulcer of the cornea produced by staphylococci. Deutschmann, as the result of extensive experience, is on the whole an adherent of this method, since he held that in the specific diseases of the eye it is distinctly quicker in its remedial action, without however being valuable in the non-specific forms. In purulent inflammation of the cornea the galvano-caustic treatment doubtless gives more certain and better results, while in parenchymatous keratitis far better results are obtained than with any other method. Acute iritis, whether of specific nature or not, appears especially adapted for this treatment. Recurrences were never observed. In chorio-retinitis the result varied, being good if the latter had a foundation in syphilitic disease, otherwise not. The same was true in the case of lesions of the optic nerve. The greatest value that the injection has is in the treatment of the infectious processes in the eye, in which the success often surpasses all expectations. Dufour agreed entirely with these statements, while Gutman could report nothing but contradictory observations, and in many cases had observed not only no improvement but an actual deterioration. So also Bach was unable to establish any favorable influence experimentally, and Chibret saw good results only in specifically syphilitic cases and in purulent infective processes.

31. THIER (Aachen) presented his observation upon the *correction by operation of myopia of high degree*, basing his statements upon 38 cases, comprising 11 patients in whom he had performed a bilateral and 16 in whom he had performed a unilateral operation. In almost every case there occurred an essential improvement in the ability of the eye to do near work. Medium-sized

print was read in 16 of the cases observed. T. believes in performing the operation upon both eyes in young patients and when the internal conditions of the eye are good, while in the case of elderly persons and more pronounced pathological changes of the fundus he does a unilateral operation. In 2 cases detachment of the retina set in later, but this is no proof either for or against the hypothesis that the operation aggravates the bad condition present. Nor can our experience with respect to the progress of retino-chorioiditis posterior be regarded as yet complete. A total division down to and through the posterior capsule is always made. Increase of tension was never observed; rapid swelling is desirable. If distinct turbidity and swelling do not develop after 8 days the discission is performed again. Youth is, of course, the preferable age for the operation, although in one case it was done successfully at the age of forty-eight.

32. FUKALA (Karlsbad) spoke in regard to the *special indications for performing the operation* and made the following statements: (1) Discission with subsequent paracentesis is the best method of operating. (2) Any age up to forty is suitable for the operation. (3) Cases with marked atrophic chorioiditis and detachment of the retina are to be excluded. (4) The intra-ocular tension is not increased, but that in the capsule is, and in the case of morbid changes in the fundus attention must be paid to this point. (5) Immediate extraction of the transparent lens is a procedure to be rejected on account of the danger of causing a detachment of the retina. (6) The highest amount of myopia for which the operation was performed was 20 D, although Schweigger operated successfully in a young person when there was 35 D. (7) But few observations with regard to detachment of the retina have as yet been communicated in spite of the fact that the experience with the method is now pretty extensive, and hence, as far as this goes, there is no proof that the latter enhances the danger. If the anterior chamber is very shallow Fukala uses a lance-knife bent a little at the point.

In the discussion Schmidt-Rimpler reported a case which showed that the sclero-chorioiditis posterior had advanced at the same rate in the eye which had been subjected to discission and in that which had not been operated upon, and from this the conclusion was drawn that it would have been better in the given case to have operated upon both eyes. Pflüger had dealt with over 40 cases and could confirm the good results obtained. The oldest

patient was forty-eight; the increase of tension which so netimes set in was relieved by repeated paracenteses. He did not consider splitting of the posterior capsule advisable.

33. NOYES (New York). An *operation for producing a central pupillary aperture* in a case of violent irido-cyclitis in which iridectomy, iridotomy, and the needle-operation was impossible, was performed by making two incisions on each side of the cornea with a Graefe knife, and then, as the knife was withdrawn, dividing the cornea and iris near the centre, cutting off the parts at the end of each puncture with a Wecker's scissors, drawing out with a hook the flap thus formed, and excising it. Darier recommended Abadie's method of iridectomy by means of two incisions made like a pair of parentheses and excision of a flap of iris with Wecker's scissors.

34. MICHEL (Würzburg) spoke upon the *minute anatomy of the ciliary ganglion.* The latter is to be denominated as a sympathetic ganglion, since its nerve-cells present markedly the character of those of the sympathetic system, being multipolar and provided with axis-cylinder processes and numerous dendrites. Each separate nerve-cell is surrounded by a fibrous investment, which is to be looked upon as the ultimate termination of the fibres of the oculo-motor nerve. Excellent microsc pical preparations served for the demonstration.

35. SWAN M. BURNETT (Washington), upon a *new metric or dioptric system for measuring and defining prisms*, which does not take for its standard the unscientific one, which consists in a determination of the apical angle, but bases its measurement of degrees upon the amount of deviation which the prism produces in a plane 1 metre distant. A measure of this sort is already generally accepted in America, and is known as a prism-dioptry (P. D.) or centrad (Cr.).

36. VALUDE (Paris) had seen in certain forms of optic-nerve atrophy good results from the *subcutaneous use of antipyrine* in a 1 : 2 solution, 2 grammes of the latter being injected every two days.

On the fourth day:

37. BORTHEN (Drontheim) presented a collection of excellently prepared photographs, tinted in water-color, showing all forms and stages of *leprous disease of the eye.*

38. RISLEY (Philadelphia) showed a new apparatus for *skiascopy*, constructed by himself.

39. AYRES (Ohio) presented a *forceps* for removing granulations and chalazia.

40. MCHARDY (London) upon the successful and certain *method of ripening senile cataract by iridectomy and massage*, upon the basis of 174 observations, from which it appeared that about 3 % required extraction immediately after the preliminary operation, while 28 % (9 %, 4 %,) did not become sufficiently ripe from a single performance of the massage. In 12 % (17 %, 20 %) a violent iritis set in; in 28 % (4 %) prolapse of vitreous occurred in the subsequently performed extraction; and in only 1.7 % did total loss occur as the result of the extraction. The series of figures above given are to be understood in the sense that McHardy had 3 sets of observations comprising 25, 100, and 49 cases, respectively, and to these the above percentages refer. He had ceased to use the cystitome for some years past, and employs for opening the capsule only the Graefe knife, the division of the capsule being performed with this before the counter-puncture is made.

In the discussion Noyes said that he considered iridectomy to be altogether unnecessary in many cases, and that, moreover, cataracts with sclerosed nucleus and a cortex that was still transparent were quite as suitable for operation as those that were perfectly ripe, especially if after-irrigation with a physiological salt-solution was employed.

41. BRONNER (Bradford) reported upon and demonstrated a case of *œdema of all four eyelids*, which was cured by the internal administration of arsenic, occurring in a man of fifty-two years of age, who presented also a swelling of the right submaxillary gland and a tumor of the palate posteriorly and on the right side. A tumor of the left lower lid was excised. Mercury and potassium iodide proved useless. It was not until arsenic had been given for two or three weeks that a noticeable subsidence of the trouble occurred, and this followed by renewed growth when the remedy was discontinued. The photographs did not show a complete disappearance, but nevertheless a very considerable diminution of the symptoms.

42. NIEDEN (Bochum) communicated a case of *sympathetic inflammation following upon a sarcoma of the chorioid of the right eye*. The case was one of a girl twenty-one years old, who had been affected 1½ years before with a spontaneous detachment of the retina. The diagnosis of a very slowly growing tumor was not established until some time had elapsed, not in fact until after

a plastic serous iritis had developed in the eye. This recurred and was then followed by similar symptoms in the other eye. In the absence of any other causal factor, the irido-cyclitis of the second eye could only be regarded as a sympathetic one, and moreover enucleation of the eye first affected proved curative, since after it the inflammation slowly abated and no subsequent relapse occurred. Dissection of the growth showed the presence of an unpigmented spindle-celled sarcoma of the chorioid which had led to moderate inflammation of the uveal tract and contained very distinctly recognizable cocci, occurring both singly and in groups. Tumor-elements were not present in the optic nerve.

In the discussion Deutschmann, who had made the microscopical examination of the eyeball, entered into an argument upon the nature of the sympathetic inflammation in this case, based upon the conditions found. He considered it of great interest that in this case micro-organisms, which were doubtless cocci and which under a high magnifying power approximated to the form of broad rods, were found not only in the immediate neighborhood of the tumor but also in the sheath of the optic nerve. This finding would sustain the diagnosis of a migratory, that is a sympathetic, inflammation, no matter what position one may take as regards his conception of the way in which the process occurs. That, moreover, it was a question of endogenous infection in this case he held to be beyond doubt, but how this infection had originated would have to be made the matter of future investigations. A demonstration of the anatomical preparations was made.

43. THEOBALD (Baltimore) spoke with regard to the *radical treatment of strictures of the lachrymal canals by means of sounds* as large as those that Cooper recommended many years ago, on the basis of the anatomical discovery that in the skeleton the canal is from 3 to 7 *mm* wide, its mean width being 4.5 *mm*. The first application is more difficult and more painful than it is with slender sounds, but the effect is thorough and permanent.

The discussion, in which Gruening, Roosa, Swanzy, Thompson, Risley, Chibret, Priestley Smith, See, and Argyll Robertson took part, was a lively one and referred to the unphilosophical nature of this treatment, the dangers produced by it, and the fatal objection, attaching to this as well as the other methods, that the *status ante quo* for the most part rapidly occurs after discontinuance of the treatment. There were but few utterances in favor of the method.

44. STÖLTING (Hannover) presented a statistical report upon the *treatment of congenital hydrophthalmus* in five cases (eight eyes) by means of *repeated sclerotomies.* Special stress was laid upon the importance of a proper after-treatment. The infliction of any kind of injury must be most carefully avoided ; the operation is done without the aid of a stop-speculum and always under profound narcosis. The first dressing is left on three days upon an average, the second two. Narcosis is necessary during the application of the dressings. After five days the after-treatment with myotics and warm compresses is begun. Arrest of the process took place on an average in fifty days. About three sclerotomies were required for each eye. Subsequent careful after-treatment continued for months is very desirable.

Gutmann advocated iridectomy, Pflüger and Thies sclerotomy, Dufour myotics.

45. MALGAT (Nice) had seen very good results in the *treatment of trachoma by electrolysis.* This was independent of the fact that general hygienic and dietetic measures are of primary importance in the treatment. He used the negative electrode, operating in several sittings with intervals of two or three days. There was no re-formation. He regarded the action of electrolysis as consisting first in its chemical effect upon the granulations, second in its antiseptic action, and third in the fact that the electric current in itself exerts a disinfecting influence upon diseased tissues.

Chibret did not believe in the hygienic causal factors of trachoma, but only in its being a racial disease and one affecting especially the Semitic race.

46. RISLEY (Chicago) communicated his observations upon *abnormities of equilibrium of the eyeball,* as produced in many cases by congenital anomalies, and also by irregularities of the muscular apparatus.

47. STEVENS (New York) made the following statements with regard to the *mutual relationship between accommodation and convergence :* (1) There is no innate relationship between the degree of activity of accommodation and convergence, and the connection which does exist is rather to be regarded as the result of the habitual association of these two functions. (2) The proportion of cases of strabismus convergens with hypermetropia and of strabismus divergens with myopia has been exaggerated. (3) The cases of strabismus which are cured by positive or negative

spherical glasses are cases of hypertropia or hyperphoria, and the success of the glasses is referable merely to their prismatic action. (4) Associated accommodative effort is not to be regarded as a causal factor in producing the development of strabismus convergens.

48. SAUVINEAU (Paris) described cases of *paralysis of the movements of looking up and down, and of convergence*, in which the lateral movements of the eye were perfectly intact. Such cases had already been depicted by Parinaud in 1883. The anatomical cause of this motor disturbance lies very probably in the supranuclear centre of co-ordination (subependymal gray substance of the corpus quadrigeminum), by lesion of which paralyses of the most different kinds of associated and conjugate movements of the eyes are produced. These paralyses are always bilateral.

49. CHEVALLEREAU (Paris) has seen a *permanent cure of the ophthalmoplegia due to tabes* occur in two cases, after he had divided the external rectus on account of the persistence of the oculomotor paralysis, and had thus brought back the eye to the middle line, and by this means done away with the preponderance of force opposing the action of the paralyzed muscle.

In the business meeting Utrecht was selected by an almost unanimous vote as the place of the next meeting, with Snellen and Dojer as managers, and it was decided, in case the International Medical Congress should not meet, as it is generally assumed that it will, in 1899, but should be called together in 1900, that, in order to avoid a collision, the International Ophthalmological Congress should be called for the year 1899, that is, five years from now. Then Noyes, in a long, ringing speech, gave the hearty thanks of the assembly both to the university authorities, the scientific societies, and the city government for the welcome that they had universally given, and more especially to the presiding officers, for the decision and yet constant justice with which they had acted. Then, after the customary expression of thanks by the personages thus honored, the Congress closed.

The exhibition of scientific apparatus and instruments was conspicuously marked by the absence of the larger London houses. It contained particularly rich collections on the part of French contributors (A. Luër, Major v. Genisson of Paris, etc.). In the bibliographical department the recently issued atlas of Oeller (Munich) excited general attention and admiration, both

on account of the precision, truth, and accuracy with which it reproduced drawings of the fundus, and also on account of the beauty and skilful execution of the pictures, and the permanent character of the materials used in the plates (oil-prints), which, because of all these advantages would seem particularly adapted for being used as objects for clinical instruction.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FIRST QUARTER OF THE YEAR 1894.

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WITH THE CO-OPERATION OF

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Translated by Dr. Ward A. Holden.

Sections I.–V. Reviewed by Dr. S. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, AND TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS. STATISTICAL REPORTS.

423. Orlowsky. Short report of the patients treated in his private hospital in 1892 and 1893. *Wjestn. Opht.* 1894, No. 2.

424. Bayer. Report on the work in the ophthalmic department of the Reichenberg Hospital in 1893. *Correspondenzblatt des Vereins deutscher Aerzte in Reichenberg und Umgebung*, 1894, No. 4.

425. Manhattan Eye and Ear Hospital. Report of eye diseases treated during the year 1893.

426. Eye, Ear, Nose, and Throat Hospital of New Orleans. Fourth annual report. Dr. A. W. De Roaldes, Dr. H. D. Bruns, ophthalmologists.

427. SCHÖLER and ALBRAND. Experimental studies on galvanolytic-kataphoric action on the eye. Bergmann, Wiesbaden, 1894.

428. SCHREIBER, P. Eleventh annual report of the institution for eye diseases in Magdeburg. Press of the Institution, Magdeburg, 1894.

429. BROOKLYN EYE AND EAR HOSPITAL. Drs. Mathewson, Prout, and Rushmore. Report for 1893.

430. OPHTHALMIC HOSPITAL OF CINCINNATI. Drs. Sattler, Ayres, Goode, Forchheimer, Holmes, Vail, and Row. Report for 1892 and 1893.

431. PANAS. *Maladies des Yeux.* Two vols. Masson, Paris, 1894.

ORLOWSKY (423) reports on 1388 eye patients, 22.9 % of all the patients seen. 283 major operations were made, 174 of these being extractions. HIRSCHMANN.

BAYER (424) in 1893 treated 797 eye patients, 407 men and 390 women. 169 major operations were made, 39 cataract extractions with flap section and iridectomy, 7 with linear section, and 11 discissions. With the flap extraction 97.2 % were successful, 2.8 % partially so. 14 of the 42 iridectomies were done for glaucoma.

(425). Number of cases treated, 10,640. Number of operations, 1,411 (including the minor ones). Simple extractions, 76. Gräfe extractions, 4. After preliminary iridectomy, 5. BURNETT.

The number of eye patients at the Eye, Ear, Nose, and Throat Hospital of New Orleans (426) for 1893 was 2587. A most thorough statistical table accompanies this report in which the whites and negroes are recorded separately. There were 289 operations of which 27 were for cataract. BURNETT.

SCHÖLER and ALBRAND (427) after a number of experiments with galvano-puncture and kataphoresis, come to the following conclusions. 1. Galvano-puncture increases metabolism in the interior of the eye. Water, salts, and albuminous compounds are decomposed and thereby adhesive chorio-retinitis produced. 2. In galvano-puncture we possess a means of producing reactive changes in the eye for therapeutic purposes, that is readily controlled. One case of detachment of the retina in myopia was cured by its use. 3. The kataphoresis of iodide of potassium takes place in and through the eyeball with changes in the interior of the eye differing from the changes produced by galvano-puncture

and the simple galvanic current, in their greater intensity and in the absence of cauterization.

In SCHREIBER'S (428) institution there were treated in 1893, 1864 patients. The average duration of hospital treatment was 12 days. 214 major operations were made, 41 extractions and 29 iridectomies.

Report of Brooklyn Eye and Ear Hospital for 1893 (429) shows 7738 new eye cases. Simple extractions, 9; with iridectomy, 25. BURNETT.

(430). Total number of cases treated in the two years, 3578. Number of major operations 704, of which 89 were simple extractions, and 31 with iridectomy; 61 enucleations and 5 exenterations. BURNETT.

All those whose good fortune it has been to hear the lucid and finished clinical lectures of PANAS have awaited with eagerness the appearance of his text-book, which, as his friends knew, has long been finished (431). His great clinical penetration, unusual experience, astonishing memory, and the gift of grasping each affection in its entirety and to its last details, lend a particular charm to his expositions, which are the more interesting since nearly all conclude with a presentation of his personal views and fixed convictions. A glance at the book will disappoint those who expected to find simply a collection of clinical lectures.

Instead of mere personal experiences, even though treated in his well-known graceful style, there is revealed a utilization of the entire literature; and the discussion of personal opinions has given place to scientific criticism aiming to separate established truth from hypothesis. Frequent citations enable the reader to refer to the original literature when he wishes to form an independent judgment on any subject. The author has thus in a happy manner observed those features that distinguish a text-book from a collection of lectures.

Since the days of Desmarres and Mackenzie, no one author has undertaken to cover the field of ophthalmology to such an extent without assistance, and to this fact the book owes its chief merits: uniform and original presentation of the subject, completeness, and absence of repetition.

In respect to style we see the author's characteristic clearness, without tediousness, and we find an equally thorough treatment of all the sections, the practical not being neglected for the theoretical.

The appearance of Panas's book is an event, and being convinced that it will soon be in the hands of every one we refrain from giving any account of its contents.[1] One characteristic feature of the new work, however, should not be passed over in silence—that is, the manner in which the literature has been taken into consideration. For the first time a single author has throughout his book cited the fundamental treatises in the various departments, whatever the language in which they have appeared, and whatever the school in which they have had their origin. The author's desire to be impartial has perhaps been carried too far, leading him to keep the French literature too much in the background. But this is the sole objection we would make to a book otherwise above criticism. SULZER.

III.—INSTRUMENTS AND REMEDIES.

432. REICH. Forceps for ectropionizing and fixing the upper retro-tarsal fold, with a few words on the introduction of sutures in this region. *Wjestn. Ophtalm.*, 1894, No. 2.

433. WELCHI. Forceps with aseptic articulation. *Arch. d'opht.*, xiv., 1, p. 64.

434. DEBAYORY-MOKRYEWITSCH. A comparison of the action of bichloride of mercury, biniodide of mercury, and sulphate of copper in the treatment of trachoma. *Wjestn. Ophtalm.*, No. 1, 1894.

435. ASMUS. The sideroscope. An apparatus for demonstrating the presence of iron or steel splinters in the interior of the eye. *Graefe's Archiv*, xl., 1, p. 280.

436. HAAB. On the employment of very large magnets after injury of the eye with splinters of iron. *Correspondenzblatt der Schweizer Aerzte*, xxiv., 1894.

437. BERNHEIMER, S. An instrument case for cataract operations and iridectomy. *Zehender's klin. Monatsbl.*, xxxii., p. 98.

438. HERTY, ERNST. On the usefulness of some new antiseptics in ophthalmology. *Inaug. Dissert.*, Munich, 1892.

439. MANZ. Demonstration loupe. *Zehender's klin. Monatsbl.* xxxii., p. 100.

440. RICHTER, P. V. Studies on the use of peroxide of hydrogen and hydroxylamin as antiseptics in ophthalmology. *Inaug. Dissert.*, Munich, 1893.

[1] Compare book notices at the end of this volume.

441. DE SCHWEINITZ, G. E. and E. A. A further communication on the results of a bacteriological examination of the pipettes and collyria taken from a treatment case used in ophthalmic practice, with the effect of inoculations. *Annals of ophth. and otol.*, April, 1894.

442. POOLEY, T. R. The action of the hydrochlorate of scopalamin on the eye. *Amer. Journ. of Ophth.*, March, 1894.

443. GOULD, G. M. An arrangement of prisms for testing adduction, abduction, exophoria, and esophoria. *Med. News*, Feb. 3, 1894.

444. ALT. On subconjunctival injections as a therapeutic measure. *Amer. Journ. of Ophth.*, Feb., 1894.

REICH's (432) clamp is a modification of Desmarres' chalazion clamp, the perforated blade being 7 *mm* broad, while the unperforated blade is 15 *mm* broad, each being 26 *mm* long. The perforated blade is passed under the upper lid and the screw tightened, the upper lid is then ectropionized and the retro-tarsal fold exposed. By employing this instrument he is able to cut out a portion of the retro-tarsal fold in cases of follicular conjunctivitis and suture the cut edges. HIRSCHMANN.

WELCHI's (433) forceps are detachable at the joint, permitting them to be readily cleaned.

DEBAYORY (434) finds that biniodide of mercury solutions cause less pain and have greater antiseptic action than bichloride. Both, however, cause hyperæmia and increased secretion, but have little effect upon the granulations. Both are inferior to sulphate of copper in the treatment of trachoma. HIRSCHMANN.

ASMUS (435) had constructed an apparatus similar to Lamont's magnetoscope, but simpler, which, as his experiments show, will demonstrate the presence of iron in the eye, and also localize it if all the meridians are tested. The apparatus is manufactured by Sitte of Breslau and sold at 86 marks.

The results of the DE SCHWEINITZES' (441) investigations is that of the organisms found in solutions used in a treatment case, the proteus vulgaris, the micrococcus prodigiosus, and the bacillus simplex introduced into the anterior chamber are capable of producing a purulent inflammation of the iris and cornea and deeper coats of the eye. BURNETT.

The conclusions at which POOLEY (442) has arrived after a fair trial with the muriate of scopalamine are that it is of value as a mydriatic and cycloplegic in refractive cases, its action benig

about the same duration as homatropine and more complete. It produces its toxic effects sooner than homatropine.

BURNETT.

GOULD (443) has arranged a series of prisms from 1° to 20° in a double row in a horseshoe frame, and in such manner that they can be brought before each eye basis "in," "out," "above," or "below." BURNETT.

ALT (444) has tried the subconjunctival injection of bichloride of mercury 1 to 1000, according to the manner recommended by Darier, in iritis and irido-choroiditis, and with marked benefit.

BURNETT.

IV.—ANATOMY.

445. BACH. On the vessels of the eye of the horse with particular reference to the vascular supply of the choroid. *Report of the Physico-Medical Society of Würzburg.*

446. GREEN, LEEDHAM. On the significance of the goblet cells of the conjunctiva. *Graefe's Archiv*, xl., p. 1.

GREEN (446) has studied preparations of the fresh and hardened conjunctiva of man and animals in order to ascertain whether the goblet cells of the conjunctiva are to be regarded as unicellular glands or as pathological formations. In no case were goblet cells entirely absent. The cells are large, with a distinct double-contoured membrane, and have a nucleus near the foot. Toward the surface of the cells is a fine stroma, through which the mucus is excreted. The cells are more numerous in the retro-tarsal folds and the conjunctiva of the ball, and become less frequent toward the free margin of the lid. The author regards these cells as a constant component of the normal conjunctiva. Their physiological function is the secretion of mucus.

V.—PHYSIOLOGY.

447. GUILLOZ. The field of observation in the examination in the upright image. *Arch. d'opht.*, xiv., 2 and 3, p. 118.

448. VIALET. The cerebral centres of vision and the intra-cerebral nervous visual apparatus. *Ann. d'ocul.*, cxi., p. 161.

449. LAGRANGE. On the equality of the retinal images in corrected axial ametropia and in emmetropia. A new elementary demonstration. *Ibid.*, cxi.

450. HEDDAEUS. The centripetal pupillary fibres and their function. *Festschrift zur Feier des 50 jährigen Jubiläums des Vereins der Aerzte des Reg.-Bez. Düsseldorf.*

GUILLOZ (447) concludes (1) that the field of observation in the upright image is practically smaller than that found by computation, but larger than Helmholtz gives it. 2. It increases with dilatation of the pupil of the observer and the observed, and decreases as the distance between the two pupils increases. 3. In ametropia of curvature it is greater in hyperopia and less in myopia. 4. In axial ametropia the size varies with the relation of the anterior focal points to the distance between the eyes. 5. In order to have it as great as possible, the central perforation in the ophthalmoscope must be large. The field of observation is at least as large as the field of vision. V. MITTELSTÄDT.

Brissaud's view (*cf.* previous report) that the cuneus does not belong to the cortical visual sphere is refuted by the microscopic preparations of VIALET (448). The former believed that the cortical portion of the cuneus was separated from the optic radiation by a layer of white substance composed of fibres having a vertical course (lame festonnée). Vialet shows that these fibres have various courses. The accurate examination of cases of partial atrophy of the cortex of the cuneus shows that the cuneus fibres pass partly into the optic radiation (projection fibres) and partly into various portions of the brain (association fibres).

SULZER.

Sections VI.–XI. Reviewed by DR. HORTSMANN.

VI.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

451. SOUTHARD. The eyes of California students. *Zeitschr. f. Schulgesundheitspflege*, 1894, 2, p. 74.

452. COHN. On the decrease of vision with age. *Graefe's Archiv*, xl., 1., p. 326.

453. WIDMARK. On the correction of myopia of high degree by extraction of the lens. *Hygiea*, 1894, p. 23.

454. v. HIPPEL. On the operative treatment of myopia of high degree. *Münch. med. Wochenschr.*, 1894, No. 8, p. 157.

455. SCHIRMER, O. The operative treatment of myopia of high degree. *Deutsche med. Wochenschr.*, 1894, No. 11, p. 261.

456. SCHRÖDER. On the results of the operative treatment of myopia by the extraction of the transparent lens. *Wjest. Ophtalm.*, 1894, No. 2, 101.

457. HOTZ. On the therapeutic value of weak lenses. *Journ. Amer. Med. Assoc.*, March 31, 1894.

458. LANGE, O. On the action of the accommodation on the eye. *Zehender's klin. Monatsbl.*, xxxii., p. 94.

Among 311 students at the California University, between the ages of sixteen and twenty-seven, SOUTHARD (451) found 4.81 % myopic, and 24.49 % astigmatic.

COHN (452) found the visual acuteness of those inhabitants of Schreiberhahn who had healthy eyes to be $\frac{3}{5}\frac{7}{0}$ at the age of sixty, and the same at seventy, and $\frac{3}{5}\frac{6}{0}$ at eighty. Boerma and Walter found in Leipsic at the same ages v = $\frac{5}{6}\frac{6}{0}$, $\frac{5}{6}\frac{2}{0}$, and $\frac{4}{6}\frac{6}{0}$, while Donders found $\frac{4}{6}\frac{3}{0}$, $\frac{3}{6}\frac{2}{0}$, and $\frac{3}{6}\frac{3}{0}$.

WIDMARK (453) performed discission, and seven days later extraction on the eye of a servant girl, æt. twenty, with myopia 20 D, and vision 0.2. Six weeks later there was hyperopia 0.5 D, and vision 0.4 and 0.5. He believes that there are other factors besides the lengthening of the axis, which determine the refraction of the eye, *e. g.*, the distance of the lens from the cornea. He refers to the following case. A woman, æt. seventy, with prominent long eyes, deep anterior chamber, retracted and tremulous iris, and opacity of the posterior cortex of the lens, had a myopia of only 9 D; after extraction of the lens the eye was emmetropic. He discusses briefly the different views on the effect of the operation on the myopic process, and believes himself that in the highest grades of myopia extraction is only to be considered a *dernier ressort*, and that one eye only should be operated, and then only when there are no great changes in the fundus. SCHIÖTZ.

v. HIPPEL (454) reports the results of the operative treatment of eleven cases of high myopia. He made discission, and later extraction in both eyes in three cases, and in one eye in five cases. The acuteness of vision, which was between 0.1 and 0.2, increased in every case, in one from 0.2 to 0.7.

SCHIRMER (455) made discission in two cases of myopia, one of 18 and one of 20 D. The acuteness of vision increased in one from $\frac{1}{5}$ to $\frac{1}{2}$, and in the other from $\frac{1}{4}$ to $\frac{1}{3}$.

After an experience of ten operations on nine patients in the St. Petersburg eye institution, SCHRÖDER (456) recommends

anew the operation of Fukala. The patients operated ranged from seventeen to thirty-seven years, their myopia from 14 to 24 D. The acuteness of vision before the operation was 0.1–0.3. The operation consisted of a preliminary iridectomy upward, some weeks after which discission was made, and four to seven days later, after the lens had become opaque, a linear extraction was made with a lance-shaped knife, the section being lateral. If necessary, a secondary discission was made. The acuteness of vision finally obtained was 0.3 to 0.6 with correcting glasses; without glasses, more than 0.1, in one case 0.3, and in one case of emmetropia, 0.6. In one case with chorio-retinitis at the macula vision was much impaired by an extravasation in the macula. In one case, in which there had been incarceration of the iris, the eye was lost a year later from purulent irido-choroiditis.

Detachment of the retina was not seen either immediately after the operation, or later.

HOTZ (457) believes that in the majority of cases, the correction of any ametropia of 0.75 D or more and of astigmatism of 0.25 D is of great benefit, and he cites a number of cases in support of his view. BURNETT.

LANGE (458), in a girl of twelve with myopia 6 D, found a marked accumulation of pigment in the conus. After treatment with atropia the myopia decreased to 4.5 and the pigment disappeared. Lange believes that the latter effect was due to the relaxation of the choroid following abolition of the accommodation, and the circulatory changes caused by the atropine.

VII.—LIDS.

459. FERNANDEZ, SANTOS. The treatment of trichiasis and districhiasis by advancement of the upper lid. *Arch. d'opht.*, xiv., 2, p. 96.

460. STORY, J. B. Blepharo-cheiloplastic operation in trichiasis and entropium. *Zehender's klin. Monatsbl.*, xxxii., p. 57.

461. FUKALA. Two new methods of treating ectropium consecutive to blepharitis, and senile ectropium. *Ann. d'ocul.*, cxi., p. 43.

462. CZERMAK. A slight modification of the so-called canthoplastic operation of Von Ammon. *Zehender's klin. Monatsbl.*, xxxii., p. 87.

463. PERGENS. A new method of treating ptosis. *Ibid.*, xxxii., p. 18.

464. St. John, S. B. Restoration of the upper lid by a pedicle flap from immediately below the lower lid. *Trans. Amer. Ophth. Soc.*, 1893.

465. Sourdille, Gilbert. Contribution to the study of primitive epithelioma of the Meibomian glands. *Arch. d'opht.*, xiv., 3, p. 179.

466. Bernhardt, M. A contribution to the subject of the synchronous movement of the paretic upper lid in congenital unilateral ptosis. *Neurolog. Centralbl.*, 1894, No. 9.

467. Gruening. A case of spindle-celled sarcoma of the lid. *Trans. Amer. Ophth. Soc.*, 1893.

468. Noyes. Clinical contributions. *N. Y. Eye and Ear Infirmary Reports*, Jan., 1894.

The purpose of Fernandez's (459) operation for entropium and trichiasis is to draw the upper lid forward away from the ball and to make the insertion of the orbicularis muscle movable. After splitting the outer commissure, the upper lid is detached at this point for a distance of 1 *cm* upward, a pedunculated flap from the temple is introduced, and the commissure is again closed. All traces of the operation disappear in a few months.

v. Mittelstädt.

In cases of trichiasis with entropium, Story (460) makes the Flarer intermarginal section and transplants a flap of mucous membrane, 3 *mm* broad, taken from the lip. The mucous membrane must be firmly sutured in the wound. The advantage of the operation is that no shrinking cicatrices remain, and no tissue is removed from the already shortened lid.

In cases of ptosis, Pergens (463) makes an arched incision through the skin below the orbital margin from one canthus to the other. A two-edged knife is passed beneath the upper margin, and the skin loosened upward and to the sides. A double-threaded needle is passed in close to the margin of the flap in the middle and is brought out above the brow. A needle is similarly passed at each end of the flap, and the sutures drawn tight and knotted.

St. John (464) reports two cases of successful restoration of the upper lid by means of a flap taken from the lower lid in such a manner that the resulting scar falls in the natural fold.

Burnett.

After a brief *résumé* of the scanty literature on malignant tumors of the lids, Sourdille (465) describes a case of epitheli-

oma of the Meibomian glands. A tumor the size of a pea, of cartilaginous consistence, developed within three weeks in the outer third of the lower lid of a man aged fifty-nine. The tumor projected on the inner surface of the lid, and was scraped out. It soon returned, however, and finally an extensive operation was made for its removal and the wound covered by sliding flaps. Eight months later there was no sign of return. Microscopic examination proved the tumor to be an epithelioma.

BERNHARDT (466) described a case in which the patient could only elevate the upper lid slightly and with difficulty. When the mouth was opened wide the lid was spontaneously raised.

GRUENING'S (467) patient was a man of twenty-three, who five years before had noticed a swelling the size of a pea on the lower lid of the right eye. At first it bled freely, but not so afterwards. It was removed two years later, but recurred, and when seen by Gruening was the size of a hazel-nut, and involved the outer two-thirds of the lid. A colored picture shows its appearance at that time. A piece of the affected conjunctiva was removed for examination, and it was found to be a spindle-celled sarcoma. The diseased tissue was removed and replaced by a flap with a pedicle from the right temporal region. The sutures were removed on the fifth day, and union by first intention was found. Case not seen since it was discharged. BURNETT.

NOYES'S (468) contributions are ten in number, and can be hardly more than enumerated here. Case 1. Epicanthus, which was operated upon with a good result. 2. Necrosis of the orbit; deformity removed by burying a flap. 3. Blepharo-phimosis from trachoma relieved by making a canthotomy and inserting a flap of skin in the opening. 4. Ectropion of both eyelids; Wolfe's transplantation successful. 5. Epithelioma of the lower lid. In this the first operation after removal of the contents of the orbit was the lining of the bony wall with the skin of the upper lid. 6. Capsular cataract; foreign body on the retina for sixteen years. 7. Traumatic cataract; partial spontaneous recovery. 8 and 9. Traumatic dislocation of the lens into the vitreous. 10. Hypermature cataract keratitis diffusa. BURNETT.

VIII.—LACHRYMAL APPARATUS.

469. BAAS. On some rare affections of the lachrymal apparatus. *Münch. med. Wochenschr.*, 1894, No. 6.

470. SCHROEDER, TH. Actinomyces in the lower canaliculus. *Zehender's klin. Monatsbl.*, xxxii., p. 101.

471. HUTH. A case of actinomycosis of the eye. *Centralbl. für prakt. Augenheilk.*, 1894, p. 106.

472. MAZET. Bacteriological researches in two cases of phlegmonous lachrymal tumor. *Ann. d' ocul.*, cxi., p. 211.

473. BERGER. Neurosis of secretion of the lachrymal gland. Lachrymation and dryness of the conjunctiva with exophthalmic goitre. *Arch. d'Opht.*, xiv., 2, p. 101.

474. ROHRER. Relation between ocular affections and those of the nasal fossæ and the organ of hearing. *Annal. d'ocul.*, cxi., p. 20.

475. SCHWARZSCHILD. A unique case of dacryocystitis with remarks on the pathology of the disease. *Manhattan Eye and Ear Hospital Reports*, January, 1894.

SCHROEDER (470) removed from the lower canaliculus of a woman aged thirty-four a small, yellowish-green body that proved to be actinomyces nodules. He believes that streptothrix and actinomyces are identical and that all cases of occlusion of the caniculi by fungi hitherto reported were due to the development of actinomyces.

HUTH (471) described a similar case where the disease was at first mistaken for a chalazion.

MAZET (472) found in the pus of phlegmonous dacryocystitis two different microbes, of which he made cultures, a streptococcus and a small bacillus. A pure culture of the streptococcus injected into the ear of a rabbit produced a fatal erysipelas, while the bacillus was not pathogenic for the rabbit. SULZER.

According to BERGER (473) the lachrymation caused by nasal disease cannot be explained by swelling of the erectile tissue of the turbinates. The symptom is found in cases of disease at other points in the nose, and in the accessory cavities, pharynx, and teeth. v. MITTELSTÄDT.

The particular interest in SCHWARZSCHILD'S (475) case was an exostosis which almost filled the nasal duct about 6 *mm* from the upper end and which he removed with a gouge devised for the purpose. The epiphora was cured. BURNETT.

IX.—MUSCLES AND NERVES.

476. JOHNSON, W. B. Suppression of the visual image. *Trans. Amer. Ophth. Soc.*, 1893.

477. KRAUS. Unilateral paralysis of the superior oblique after diphtheria. *Centralbl. f. prakt. Angenheilk.*, 1894, p. 93.

478. HOSCH. Complete paralysis of all the ocular muscles. *Arch. f. Augenheilk.*, xxviii., p. 311.

479. SACHS. Isolated paralysis of the inferior oblique of the left eye (traumatic enophthalmus). Relieved by tenotomy of the right superior rectus. *Beiträge z. Augenheilk.*, xiv., p. 44.

480. BRUGGER. On hyalin and amyloid degeneration with calcification and ossification in an ocular muscle, after traumatism. *Arch. f. Augenheilk.*, xxviii., p. 282 (will be translated).

481. BARNES. On symptomatic heterophoria. *New York Med. Jour.*, April 28, 1894.

482. THEOBALD. Cases of lateral heterophoria in which the vertical diplopia test provedun trustworthy. *Trans. Amer. Ophth. Soc.*, 1893.

483. HANSELL, H. J. Two cases of functional nervous disease treated by tenotomy of the superior and inferior rectus muscles. *Med. News*, March 3, 1894.

JOHNSON's (476) case was that of a man of nineteen, who had a left convergent squint from his third year. The vision in this eye consisted in the ability to count fingers at six inches, not improved by glasses. The right eye was injured and was enucleated. The left eye had at first excentric fixation, but with practice the vision became in fifteen days $\frac{10}{15}$, and the visual field became complete. There was hyperopia of 1.25 D. BURNETT.

In a woman of forty-nine with carcinoma of the uterus and bladder, HOSCH (478) found a paralysis of all the muscles of the left eye, with slight pallor of the disc. At the autopsy there was found a carcinoma of the brain that had involved the left optic nerve and the motor nerves of the eye.

Of the 250 cases of heterophoria which form the basis of BARNES's (481) observations, 200 were relieved by the correction of the ametropia. Prisms he does not rely upon for permanent use. Tenotomy, of which he is an advocate in suitable cases, he performed in 20 cases. BURNETT.

THEOBALD (482) gives several illustrative cases of the failure of the vertical diplopia test with prisms to give evidence of heterophoria, while the cornea test showed very marked divergence. BURNETT.

HANSELL (483) gives the histories of two cases of epilepsy in young women which was cured completely [?] by the correction of hyperphoria of 2 or 3 D in one case and 4 D in the other by means of tenotomies. BURNETT.

X.—ORBIT AND NEIGHBORING CAVITIES.

484. Hirsch. On orbital phlegmon. *Prager med. Wochenschr.*, 1894, No. 14–18.

485. Lange. Two cases of melano-sarcoma of the orbit. *Zehender's klin. Monatsbl.*, xxxiii., p. 60.

486. Goldzieher. On a case of freely movable fibroma of the orbit. *Centralbl. f. prakt. Augenheilk.*, 1894, p. 65.

487. Snellen, H., Jr. Inflammation of the orbit and neighboring cavities. *Weekblad*, i., p. 205.

488. Reeve. A case of single pulsating exophthalmus, due to trauma. Ligation of both common carotids with imperfect result. *Trans. Amer. Ophth. Soc.*, 1893.

489. Bayer. Demonstration of a case of pulsating exophthalmus. *Corr. d. Ver. deutscher Aerzte in Reichenberg und Umgebung*, No. 3, 94.

490. Pomeroy, O. D. Clinical cases. *Manhattan Eye and Ear Hospital Reports*, Jan., 1894.

491. Dunn, Thos. J. A case of leukæmia with rare lymphoid growths of orbits and parotid glands. *Amer. Jour. Med. Sciences*, March, 1894.

492. Harlan. Case of congenital cyst of the orbit with anophthalmus. *Trans. Amer. Ophth. Soc.*, 1893.

Hirsch (484) describes seven cases of phlegmon of the orbit. In three cases the phlegmon followed the extraction of a carious molar of the upper jaw on the same side, and led in one case to suppuration of the ball, in the other simply to atrophy of the optic nerve. In the fourth case the phlegmon was due to an empyæma of the antrum of Highmore, which arose from a periostitis of the root of a tooth. In this case also there was atrophy of the optic nerve. The fifth case was caused by a dacryocystitis, due to a specific ulcer of the mucous membrane of the mouth and pharynx. Here there was the picture of embolism of the central artery of the retina. The sixth case was due to autogenous infection, and there was ulceration of the cornea. The seventh case was that of an infant with abscesses over the entire surface of the body. The orbital plegmon caused ulceration of the cornea. The infant finally died of pneumonia. Blindness from orbital phlegmon with intact eyeball is due to retrobulbar neuritis, pressure on the nerve, or interference with the circulation of the nerve and retina.

GOLDZIEHER (486) reported a case in which he removed a fibroma 3 *cm* long and 2 *cm* broad with preservation of the ball. The tumor originated in the retrobulbar cellular tissue

A bony tumor developed at the nasal side of the orbit and was extirpated. In the nose was a polyp which was also removed. After incision of the tumor, muco-pus escaped from the wound and a large cavity was revealed, which was evidently the ethmoid sinus.

SNELLEN (487) believes that diseases of the neighboring cavities play a more important rôle in the pathology of the eye than is generally supposed. In the Utrecht clinic there was observed a case of retrobulbar tumor with signs of pressure on the optic nerve, which improved after a free discharge from the nose. This possibly had its origin in the ethmoid. WESTHOFF.

In REEVE'S (488) case a man was kicked on the lower jaw by a horse. Two days later he began to hear sounds in his right ear and four weeks later there was exophthalmus with swelling of the veins about the eye, the displacement of the ball being down and out. V = $\frac{20}{40}$. Hyperæmia of the right papilla. The eye advanced 1 *mm* with each systole. A bruit was heard at the right temple. Iodide of potassium, digitalis, and ergot were used without benefit, and finally the right common carotid was tied, with some improvement, and a year later the left, with greater improvement, but without complete recovery. BURNETT.

BAYER (489) demonstrated a case of pulsating exophthalmus in a man of thirty-five, who had fallen over a wall eight weeks before. At the time he heard a snap and since then there had been a continuous buzzing, with the usual symptoms. Digital compression was useless and ligaturing of the carotid was refused. HERRNHEISER.

The following is an enumeration of some of POMEROY'S (490) clinical cases. 1. Removal of a round-cell sarcoma of the orbit without return—a similar tumor removed four years ago. The tumor was in the upper part of the orbit and was the size of a hickory nut. 2. Removal of a transparent staphyloma of the cornea, about 2½ lines in diameter, by the single needle operation. The staphyloma was transfixed with the needle armed with a suture and the conical bit of cornea cut off. The needle was then drawn through and the suture tied. Good healing and improved vision. 3. Removal of a foreign body from the iris by iridectomy. The foreign body was a bit of iron and reached from the periphery of the iris to the pupil. BURNETT.

DUNN's (491) case was a boy eight years old when first seen. The child was highly leukæmic. The growths in the orbit were crescentric above the eyes and not firmly connected with the lids. They began at the nasal end of the orbit and extended to the external canthus. They were firmly attached to the orbital arches. They were not painful. Considerable exophthalmus. Motion of eye not much interfered with. Eye healthy otherwise, and vision normal. Child died. No autopsy was obtained.

BURNETT.

HARLAN (492) reports a case of congenital cyst of the orbit in a well developed child of five years. The left eye was normal. The tumor was about the size of a small hen's egg and completely filled the orbit. No evidence of an eye was found when the tumor was enucleated, nor was its definite connection with either lid demonstrated. The patient died some twenty-four hours after the operation, most probably from shock. No autopsy was obtained. A report on the examination of the tumor says that a peculiar tissue was found which resembles a typical cerebral tissue, and which contains the typical perivascular spores about the blood-vessels and nerve nuclei corresponding to those of the neuroglia. BURNETT.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

493. BURCHARDT. On the treatment of blennorrhœa. (The different methods used in the eye department of the Charité, Berlin, and their results.) *Inaug. Dissert.*, Berlin, 1894.

494. RANDALL. Can loss of eyes by ophthalmia neonatorum always be prevented? *Trans. Amer. Oph. Soc.*, 1893.

495. HIRSCHBERG. Historical notes on purulent conjunctivitis in the new-born. *Centralbl. f. prakt. Augenheilk.*, p. 40, 1894.

496. VALUDE. Membranous conjunctivitis and ocular diphtheria. *Ann. d'ocul.*, cxi., p. 92.

497. FUCHS, E. On Egyptian ophthalmia. *Wiener med. Wochenschr.*, 1894, No. 12.

498. DEMETRIADES. The purulent ophthalmia of Egypt and its relation to trachoma; its etiology. *Ann. d'ocul.*, cxi., p. 19.

499. OMELTSCHENKO. On the pathogenesis of trachomatous disease. *Centralbl. f. prakt. Augenheilk.*, 1894, p. 97.

500. TRUHART. The operative treatment of trachoma. *St. Petersburger med. Wochensch.*, 1894, No. 13.

501. PERGENS. On the value of mechanical and surgical methods of treating chronic trachoma. *Zehender's klin. Monatsbl.*, xxxii., p. 155.

502. SCHULZE. Two unusual cases of melanotic sarcoma of the conjunctiva. *Ibid.*, p. 1.

503. WAGENMANN. On papilloma of the conjunctiva with extensive formation of goblet cells. *Graefe's Archiv*, xl., 2, p. 250.

504 DAVIS, A. E. Report of purulent ophthalmia cases for the past year; their treatment and results. *Manhattan Eye and Ear Hospital Reports*, January, 1894.

505. WOODS, HIRAM. Some considerations upon the curability and treatment of ophthalmia neonatorum.

RANDALL (494) reports a case of ophthalmia neonatorum in an infant with muco-sanguinolent discharge from the anus and vulva. The infant was emaciated and poorly nourished. The eyes became inflamed the fourth day after birth, and in spite of the most attentive care both were lost. The mother, who had been very much reduced during her pregnacy, had no leucorrhœa, and the question arose, Whence the infection?

BURNETT.

HIRSCHBERG (495) believes that blennorrhœa neonatorum was known to the ancient Greeks.

To the well-known diphtheritic conjunctivitis of Graefe, and the croupous conjunctivitis first described by Bouisson and Chassaignac, VALUDE (496) adds two new forms of disease belonging to the same group: conjunctivitis pseudo-membranosa chronica and conjunctivitis pseudo-membranosa acutissima. Of the latter form there are six cases described in literature. In the last published, that of Guibert, the membrane developed for five months. Staphylococci and streptococci were found in it. The conjunctivitis pseudo-membranosa acutissima forms a stage of purulent conjunctivitis. In it there is an adherent membrane which cannot be removed, but which does not extend so deep into the conjunctival tissue as the membrane of diphtheria. The affection leads to rapid and complete destruction of the cornea.

SULZER.

According to FUCHS'S (497) observations in Egypt, the Egyptian ophthalmia is not a distinct disease, but rather two diseases, acute blennorrhœa and trachoma. The latter is the more frequent, but less dangerous. The chief cause of blindness is acute blennor-

rhœa. This is only sporadic in the winter, but is very frequent in the autumn. The gonococcus may always be found in the secretion. The chronic cases resemble our trachoma. A great number follow an acute gonococcus ophthalmia, while many develop as by us slowly and unobserved.

DEMETRIADES (498) notices the frequency of conjunctival suppuration in the course of trachoma in Egypt. He regards it as an affection accompanying or preceding trachoma and depending upon the gonococcus. Gonococcus infection in Egypt is from eye to eye, mostly through the medium of flies.

According to OMELTSCHENKO'S (499) observations, trachoma is a definite pathological process *sui generis*. The pathological beginning consists in an alteration of the conjunctival epithelium, first and chiefly in the tubular depressions or glands of Henle, which by proliferation of the cells grow to round structures which are clinically beginning granulations.

In trachoma TRUHART (500) passes a sharply ground cuvette over the conjunctiva and then rub the latter with cotton, dipped in sublimate solution. By this means, not only the projecting follicles are cut off, but those lying deeper are expressed, and the degenerated and necrotic portion of the conjunctiva removed. Finally the conjunctiva is gone over with Knapp's roller forceps, washed with sublimate solution, and painted with 5 per cent. solution of nitrate of silver.

PERGENS (501) performs brossage with scarification of the tarsus, and is well pleased with the results.

SCHULZE (502) removed a melanotic sarcoma from the sclero-corneal margin of a girl of fifteen, and had a recurrence six months later. A melanotic sarcoma removed from the eye of a woman of sixty-one, also returned and necessitated exenteration of the orbit.

WAGENMANN (503) describes a tumor removed from the inferior retro-tarsal fold. It proved to be a solitary pedunculated papilloma which was chiefly remarkable for showing quantities of goblet cells in every part.

DAVIS (504) reports on 22 cases of purulent ophthalmia, 6 of which were oph. neonatorum. Ten had both eyes affected making 32 eyes in all. Seventeen out of the 20 eyes which entered the hospital with clear cornea were discharged with useful vision, and of the 2 which entered with infiltrated cornea 1 was saved. The author favors the employment of hot water instead of the

iced application after the cornea becomes involved. Perfect cleanliness was the chief therapeutic agent, with argent. nit. and merc. bichlor. as germicides. BURNETT.

The gist of WOODS's (505) paper is to show that conjunctival purulency in a newly born does not necessarily demand nitrate of silver. He also protests against the use of cocaine for the purpose of quieting pain in such cases. BURNETT.

506. FUCHS. Keratomycosis aspergillina. *Wiener med. Wochenschr.*, 1894, No. 17.

507. NUEL. On superficial punctate keratitis. *Arch. d'opht.*, xiv., 3, p. 145.

508. GRUBER, R. On deposits of rust in the cornea. *Graefe's Archiv*, xl., 2, p. 172.

509. ELSCHNIG. On keratoconus. *Zehender's klin. Monatsbl.*, xxxii., p. 25.

510. JOHNSON, W. B. A permanent magnet for use in removing foreign bodies from the cornea. *Trans. Amer. Ophth. Soc.*, 1893.

FUCHS (506) reports the case of a man of fifty-three, whose conjunctiva on the upper lid was thickened by papillary excrescences. There was marked circumcorneal injection. In the middle of the cornea was an intense gray opacity limited by a sharp but irregular outline from the healthy cornea. On the opaque portion which appeared flattened there were yellowish white, friable, dry masses, that were scraped off, and it was found that the entire process was caused by the aspergillus fumigatus.

NUEL (507) examined a case of superficial punctate keratitis. This affection usually attacks individuals between the ages of twenty and thirty, often comes on with a coryza, and shows numerous small spots often visible only with a loupe. The inflammatory symptoms pass off in eight to ten days but the opacities remain for months. Nuel found a diffuse œdema of the cornea and epithelium, the latter resembling that found by Fuchs in glaucoma. The punctate opacities consist of a collection of fibrils of various forms grouped between the corneal lamellæ. These fibrils which seemed to be of a hyaline nature lay behind the membrane of Bowman and occasionally before it, but the membrane was always intact. There never was a cellular infiltration. The treatment is expectative. Salicylate of soda had no effect. V. MITTELSTÄDT.

According to GRUBER (508) particles of iron behave differently in the cornea according to their chemical composition. The metallic iron and the ferrous oxide are irritating, the ferric oxide is indifferent. The rust deposit remaining in the form of a ring after the extraction of a foreign body is an oxyhydrate chemically indifferent and harmless. The deposits may take place in the substance of the cornea or on the membrane of Decemet, but with more difficulty in the epithelium.

ELSCHNIG (509) by removing the apex of a keratoconus in a girl of eighteen, increased the acuteness of vision in one eye from $\frac{6}{60}$ to $\frac{6}{24}$, while in the other it remained $\frac{6}{60}$. Elschnig believes that the immediate cause of the keratoconus is a decrease of elasticity and resistance in the membrane of Decemet.

JOHNSON (510) takes a steel cylinder 3 in. long and $\frac{1}{2}$ in. thick, tapering at both ends, and magnetizes it by rotating it within a generator. It will remain permanently magnetized for a very long time. BURNETT.

511. MÜLLER, L. On cilia in the anterior chamber and their spontaneous expulsion. *Wiener med. Wochensch.*, 1894, No. 13.

A patient of twenty was struck in the eye with scissors, several lashes being carried into the anterior chamber. At first they lay on the anterior capsule of the lens, but later lay on the posterior surface of the cornea, and finally escaped through the corneal cicatrix.

Sections XII.–XXI. Reviewed by DR. P. SILEX.

XII.—IRIS.

512. BRUNN. Infectious iritis developing in the course of stricture of the urethra. *Presse médicale*, Dec. 30, 1893.

513. BERGMEISTER. Two cases of iritis. *Wierner klin. Wochenschr.*, p. 47, 1894.

514. MITVALSKY. A tumor of the ciliary region, with remarks. *Arch. f. Augenheilk.*, xxviii., p. 152.

515. KNAPP. A case of traumatic dislocation of the iris under the unbroken conjunctiva. Eye damaged, but preserved. Typical sympathetic ophthalmia in the other. *Trans. Amer. Ophth. Soc.*, 1893.

516. SAMELSOHN. Rare observations of the diagnostic value of the pupillary reaction. *Deutsche med. Wochenschr.*, No. 4, 1894.

517. KRÜGER. On the pupillary reaction, with the report of a case of unilateral reflex iridoplegia. *Inaug. Dissert.*, Berlin, 1894.

518. HARLAN, GEO. C. Tumor of the iris, probably tubercular. *Trans. Amer. Ophth. Soc.*, 1893.

BRUNN'S (512) case was as follows. A patient who had neither syphilis nor rheumatism had repeated attacks of iritis for six years. Each attack followed an acute retention of urine in consequence of a urethral stricture. SULZER.

MITVALSKY (514) gives an anatomical description of a spindle-celled sarcoma of the ciliary body that he had observed clinically, and states that in his opinion 6 of the 30 cases previously reported as myomata or myosarcomata were really spindle-celled sarcomata.

KNAPP'S (515) case was that of a man of forty-five who was struck in the left eye with the head of a pet dog ten days before the first examination. The iris was torn cleanly and completely from its attachment, and was forced under the unbroken conjunctiva through a rupture in the inner portion of the sclera 3–4 *mm* long. The lens was in position, but there was some blood in the vitreous. Twenty-nine days after the injury an iritis appeared in the uninjured eye, followed by a typical sympathetic ophthalmia with irido-cyclitis and decrease of vision to $\frac{1}{200}$. A total posterior synechia resulted. The vision in the injured eye was reduced to $\frac{3}{200}$, and there was cloudiness of the vitreous (a year and a half later V = $\frac{6}{200}$ in the injured eye, and $\frac{1}{\infty}$ in the eye sympathetically inflamed.—H. K.). BURNETT.

SAMELSOHN (516) has seen four cases of hemianopic pupillary reaction. This is of particular diagnostic importance when it appears in the course of an observed affection, since it indicates the extension of the cerebral process in a particular direction. He adds six new cases to the four hitherto observed of pupillary reaction synergetic with the abducens nerve; and he has also seen the abolition of the accommodative reaction with preservation of the convergence reaction and the optic-nerve reflexes, a symptom previously unobserved.

KRÜGER (517) gives a *résumé* of the papers on the pupillary reaction, and reports a case of unilateral reflex iridoplegia. By this he understands the condition in which one pupil reacts neither directly nor consensually, while the other pupil reacts in both manners. Both pupils contracted promptly with convergence. With Heddæus he locates the seat of the affection in the

centrifugal tract, on account of the inequality of the pupils (isocoria existing in disturbances of the centripetal tract), and in the oculo-motor root arising in the sphincter nucleus. The accommodative root is preserved, as there is accommodative reaction.

HARLAN's (518) case was of a child three years old, which on the whole seemed fairly well, and on whom no other evidences of tuberculosis were found. The right eye alone was affected, and there were the usual signs of iritis, but in addition there was a deposit on the surface of the iris, first manifest at the periphery, of yellowish-white nodules, principally at the upper outer third. This condition increased very rapidly, almost filling the ant. chamb., and the eye was removed. No bacilli were found by any of the tests, and the nodules were composed of epithelioid and lymphoid cells. The child has since done well.

BURNETT.

XIII.—CHOROID.

519. FRIDENBERG, PERCY. A contribution to the pathology of sarcoma of the choroid. *N. Y. Eye and Ear Infirmary Reports*, Jan., 1894.

520. OLIVER, C. A. Clinical history of a case of spindle-celled sarcoma of the choroid, with a study of the microscopic condition of the growth.

521. TROUSSEAU. Infectious iritis and irido-choroiditis. *Ann. d'ocul.*, cxl., p. 199.

522. GRUENING. A case of sarcoma of the choroid with remarks on the early diagnosis of intra-ocular sarcoma. *Trans. Amer. Ophth. Soc.*, 1893.

523. WEBSTER. A case of sarcoma of the ciliary body and choroid. *N. Y. Med. Journ.*, May 12, 1894.

This paper of FRIDENBERG's (519) is an account of the histological examination of the tumor of the choroid reported by Gruening at the last meeting of the American Ophthalmological Society (see *supra*). The tumor was a large spindle-celled sarcoma, and confined wholly to the choroid, and was distinctly limited. The amount of pigment it contained did not exceed the normal amount of the choroid. The growth is highly vascular.

BURNETT.

In OLIVER'S (520) case the patient was a young man of thirty-four years, in whom a growth in the choroid was diagnosticated in June, 1890. There was a history of syphilis. Early in 1892 exacerbations of intense temporal neuralgia with marked mental symptoms and a divergence of the eyeball were noted, and when seen by Oliver a distinctly outlined tumor was visible just posterior to the crystalline lens in the upper part of the globe. Enucleation was performed, and all the nervous symptoms completely vanished. The growth was composed of spindle-cells, which were small, quite uniform in size, and contained oval vesicular nuclei. Numerous cavernous spaces or sinuses ran through the growth. Another kind of channel contained large, round pigmented cells, which were considered to be leucocytes loaded with pigment granules. BURNETT.

After a short reference to the cases of iritis with hypopyon coming on at the menstrual period in women with uterine disease, and the purulent irido-choroiditis observed after puerperal infection, TROUSSEAU (521) reports the case of a patient suffering with chronic urethral stricture and vesical catarrh, in whom a purulent irido-choroiditis came on after urethral fever following catheterization Several small abscesses formed along the insertions of the muscles, in consequence of a true periocular lymphangitis. These cases together with the iritis observed with empyæma of the antrum of Highmore, and the choroiditis with dilatation of the stomach when there are exacerbations of the intestinal trouble, make up the group of infectious iritis and choroiditis.

SULZER.

GRUENING'S (522) case was a woman of thirty, who had lost the sight of one eye four months before the examination. There was a central scotoma with good peripheric vision, and exactly at the macula an elevation over which retinal vessels ran. Beneath the retina, which was nowhere detached, vessels belonging to the neoplasm could be made out. The elevation of the tumor was 20 D measured with the ophthalmoscope. Sarcoma was diagnosed and the ball enucleated. Microscopic examination showed the growth to be a vascular spindle-celled leuco-sarcoma. A good chromo-lithographic plate shows the ophthalmoscopic appearance.

BURNETT.

WEBSTER'S (523) case was a girl of ten years, who gave a history of a blow on the left orbit a year before the first examination was made. At the time of examination there was only percep-

tion of light. A tumor was seen springing from the ciliary body and choroid on the nasal side. Detachment of the retina was present close to the tumor. Eye removed and an examination made by Dr. Schwarzschild, who found the characteristics of sarcoma and none of glioma. It was confined to the ciliary body and the anterior $\frac{4}{5}$ of the choroid. BURNETT.

XIV.—GLAUCOMA.

524. NEUBURGER. A contribution to the statistics of glaucoma with reference to age. *Centralb. f. prakt. Augenheilk.*, xviii., p. 13.

525. GOLDZIEHER. A case of congenital absence of the iris, with glaucoma. *Wiener med. Wochenschr.*, 1894, No. 15.

NEUBURGER (524) found that in the first decade of life glaucoma is rather more frequent than in the two following. From that time there is a gradual increase in the frequency of the disease, that is more marked after the 40th year. Females are more frequently affected than males.

GOLDZIEHER (525) presented a patient with congenital aniridia of both eyes, and glaucoma also in both. HERRNHEISER.

XV.—SYMPATHETIC OPHTHALMIA.

526. THOMPSON, J. H. Two cases of sympathetic ophthalmia. *Ophth. Record*, Apr., 94.

527. WEEKS, JOHN E. A case of sympathetic ophthalmia occurring forty-two years after the loss of the exciting eye. Recovery with useful vision. *N. Y. Eye and Ear Infirmary Reports*, Jan., 1894.

THOMPSON'S (526) cases are as follows: 1. A man was wounded in the ciliary region of the left eye with a piece of iron which flew off from a nail-head, which, however, did not penetrate the eyeball. Eighteen months after, the degenerated and painful eye was removed. Right eye unaffected at the time. Fourteen months later it was affected with chorio-iritis which in spite of rigorous treatment went on to destruction of vision. 2. A man received a blow on the left eye from a piece of stone. The eye was blind from inflammation in infancy. Enucleation refused. In a few days inflammation in the fellow-eye with extraordinary hypotony. Offending eye was removed. Soon improvement began and the eye finally recovered its normal vision. BURNETT.

WEEKS's (527) case is one of serous uveitis as an expression of sympathetic ophthalmia caused by an eye which was lost by an idiopathic purulent keratitis forty-two years before. The immediate cause was probably an inflammation of the uveal tract, which was set up in some manner not understood just before the outbreak of the sympathetic trouble. The sympathizing eye was sound. BURNETT.

XVI.—VITREOUS.

528. WINTERSTEINER. A contribution to the symptomatology and genesis of the congenital malformations of the eye. *Arch. f. Augenheilk.*, xxviii., p. 165.

529. HOLT, E. E. Removal of steel from the vitreous by the electro-magnet. *Trans. Amer. Ophth. Soc.*, 1893.

HOLT (529) reports three additional cases of removal of steel from the interior of the eye by means of the electro-magnet, all successful. In all the foreign body entered the cornea, passing through the lens. BURNETT.

XVII.—LENS.

530. BÄUERLEIN. My experience with cataract and cataract operations during 25 years. Bergmann, Wiesbaden, 1894.

531. JACKSON, E. Indirect massage of the lens for artificial ripening of cataract. *Trans. Amer. Ophth. Soc.*, 1893.

532. TABULATED REPORT OF CATARACT OPERATIONS. *N. Y. Eye and Ear Infirmary Reports*, Jan., 1894.

533. BIRNBACHER. A new procedure for the removal of the capsule in cataract operations. *Centralbl. f. prakt. Augenheilk.*, xviii., p. 70.

534. TERSON. On the pathogenesis and the prophylaxis of expulsive hemorrhage after extraction. *Arch. d'opht.*, xiv., 2, p. 110.

535. PURTSCHER. Clinical contributions to the knowledge of lamellar cataract. *Centralbl. f. prakt. Augenheilk.*, xviii., p. 33.

536. MARPLE, W. P. Coloboma lentis. *N. Y. Eye and Ear Infirmary Reports*, Jan., 1894.

537. HOWE, LUCIAN. On the removal of hard cataract by suction. *Trans. Amer. Ophth. Soc.*, 1893.

In BÄUERLEIN's (530) book there are good clinical observations, practical hints, and interesting historical notes on cataract extrac-

tion. The fact that the author has himself operated 860 cataracts, all of which he examined, and tested the vision, increases the value of his observations. BERNHEIMER.

JACKSON (531) reports 7 cases of cataract in which he used indirect massage through the cornea for the purpose of artificial ripening, the aqueous humor being evacuated by paracentesis as suggested by Pooley. He finds the method more efficacious than that of Förster and altogether harmless. BURNETT.

Between Oct., 1892, and Oct., 1893, 73 extractions were done at the N. Y. Eye and Ear Infirmary (532). In 7 cases V = 0 or p. l. only. The majority were done without iridectomy.

BURNETT.

After the iridectomy, BIRNBACHER (533) cuts out a triangular bit of capsule behind the coloboma with a curved knife having a long tongue-formed blade. The bit of capsule is then removed with forceps.

TERSON'S (534) patient had extensive atheroma of the vessels with a tendency to congestion of the head. Heart sounds normal; urine normal. Two days after a simple flap extraction there was severe and repeated hemorrhage from the eye. Three weeks after the operation the patient was found dead in bed. There was found hypertrophy of the left ventricle and atheroma of the aorta and carotids; no valvular insufficiency and no cerebral hemorrhage. The vessels of the choroid and retina were sclerosed and the choroid was detached by the hemorrhage. The cause of the hemorrhage seemed to be an increased blood pressure, transient or otherwise, in atheromatous vessels. In the treatment of such cases veratrum should be used. When there is extensive atheroma, iodide of potassium. After one eye has been lost, a preparatory iridectomy should be made in the other.

V. MITTELSTÄDT.

PURTSCHER (535) observed in a boy of fourteen a well-marked lamellar cataract that was confined to the temporal half of the lenses. There was also an anterior polar cataract.

MARPLE'S (536) patient, aged thirty, had a high degree of M (12–15 D). Ectopia lentis upward on both sides. The lower borders of the lenses were slightly curved upward like a notched tooth. About a third of the lower half of the lenses seemed to be absent. BURNETT.

In cases where a large nucleus is fixed fast in a too small incision, HOWE (537) has sucked it out by an extemporized appa-

ratus made from an ordinary dropping tube, whose glass extremity had been enlarged so as to fit over the protruding lens.

BURNETT.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

538. HAAB. Hemorrhage between the retina and vitreous. *Deutschmann's Beiträge zur Augenheilk.*, v., 1894.

539. VAN DUYSE. On tubular glio-angio-sarcoma of the retina (conclusion). *Arch. d'opht.*, xiv., 1, p. 28.

540. DE WECKER. Is it necessary to distinguish between retinitis circinata and apoplectiform white degeneration of the retina? *Arch. d'opht.*, xiv., p. 1.

541. AXENFELD. Peculiar anomaly of the retinal circulation; reflex of the venous blood in greater part into the choroid (cilio-retinal veins at the equator). *Zehender's klin. Monatsbl.*, 1894, p. 12.

542. SALOMONSOHN. On the so-called pathological fatigue of the retina. *Berliner Klinik*, part 70, 1894.

543. CALLAN. Sudden monocular blindness lasting two months without ophthalmoscopic changes. Autopsy. *Eye and Ear Infirmary Reports*, January, 1894.

544. VAN DUYSE. A case of glio-sarcoma of the retina with recurrences and metastases. *Arch. d'opht.*, xiv., 2, p. 81.

545. BARNES, J. L. Detachment of the retina. *Ibid.*

546. NORRIS, W. F., and WALLACE, JAMES. A contribution to the anatomy of the human retina, with a special consideration of the terminal loops of the rods and cones. *University Med. Magazine*, March, 1894.

547. MITCHELL, S. WEIR. Concerning the history of the discovery of reflex ocular neuroses and the extent to which these reflexes obtain. *Med. News*, April 28, 1894.

548. STANDISH, MYLES. Retinitis punctata albescens. *Trans. Amer. Ophth. Soc.*, 1893.

VAN DUYSE (539) describes the development of the cellular sheaths about the vessels in his glio-angio-sarcoma, and believes that the process is probably a proliferation of the lymph sheaths surrounding the vessels, and not an infiltration of the latter with glioma cells.

V. MITTELSTÄDT.

DE WECKER (540) does not agree with Fuchs that the clinical picture which Fuchs has called retinitis circinata should be considered a distinct disease. He regards it rather as a very rare form of retinal disease dependent upon a vascular affection. This rare condition is found in elderly persons, and is also associated with small hemorrhages, which later become white points. De Wecker regards the process as one of fatty degeneration, but prefers the more general definition "white degeneration of the retina." The course is slow, and improvement impossible. A central scotoma appears early. De Wecker reports a case of twenty years' duration. The patient, seventeen years old when first attacked, was seen by Rothmund, O. Becker, Donders, Bowman, Arlt, and Knapp, whose views of the case he gives. He adds two observations of his own, and gives ophthalmoscopic drawings. v. MITTELSTÄDT.

AXENFELD (541) in a case of disseminate choroiditis saw the papillary veins so poorly developed, that they could carry off but a small portion of the blood from the retina. This was done for the greater part by two large veins which received numerous twigs from the retina and ran toward the periphery where they entered the choroid.

SALOMONSOHN (542) describes Graefe's anæsthesia retinæ, the displacement type of Forster, etc., but does not consider the condition one of fatigue of the retina or of the cortical centre, but rather a fatigue of attention or an indisposition of the patient for the examination, affecting neurasthenics, women and children, more than men, who are better disciplined. The weak point in his theory is the fact that there may be monocular symptoms of fatigue.

In CALLAN'S (543) case the right eye was almost blind from detachment of the retina. Some weeks later the sight of the left eye began to fail and the eye became completely blind in a few days. There was no change in the fundus. Various drugs and even hypnotism were tried with the idea that the condition was possibly nervous. Many symptoms pointed to a cerebral lesion, and at the autopsy five small gliomatous tumors were found, one beneath the angular gyrus and cuneus, a second in the white substance beneath the cortex, a third in the upper portion of the parietal lobe, and a fourth in the cerebellum. BURNETT.

VAN DUYSE'S (544) case of glio-sarcoma was not carefully followed clinically. In a girl of six with phthisical right eye after

blennorrhœa, glioma was diagnosed in the left. A year later no tumor could be seen, but the vitreous contained floating opacities, the optic nerve was atrophic, and there were atrophic foci in the choroid. A year later the eye was enucleated for glioma. Six weeks later there was a recurrence. The orbit was exenterated and the preauricular and two glands in the neck removed. It returned very soon and perforated the roof of the orbit, affecting the dura mater but sparing the brain and the optic nerve.

V. MITTELSTÄDT.

BARNES (545) reports that from Jan., '91, to Nov., '93, 97 cases of retinal detachment were seen, of which number 16 were admitted to the hospital. Of these 10 were treated by rest on the back and pilocarpine injections, and 4 were improved. The other 6 were treated by scleral puncture with a Graefe knife, and of these 3 were improved, including 1 cured, and no case was rendered worse by the treatment. Three were due to traumatism. In 3 there was myopia and in 10 there was no assignable cause.

BURNETT.

NORRIS and WALLACE (546) have here a reproduction of a photograph of a section of the retina, showing the "return loops" of the cones. The illustration shows that the cones terminate in a looped extremity which passes down over the body of the cone and often some convolutions in the position of the so-called external limiting membrane wend along among the elements of the outer nuclear layer. The reason they are not usually seen is that they are buried in the pigment and are mutilated when this is torn off. BURNETT.

In this address Dr. MITCHELL (547) gives the history of his connection with the discovery of the various neuroses due to uncorrected ocular defects. This began as far back as 1862 or 1863. He is still sceptical as regards a close causal connection between ametropia or disturbed muscular balance and chorea and epilepsy. BURNETT.

STANDISH (548) reports a case of retinitis punctata albescens which he followed from the beginning, and which would seem to be the result (regenerative) of some form of retinitis, though no history could be clearly established of syphilis, rheumatism, fever, or kidney disease.

BURNETT.

XIX.—OPTIC NERVE.

549. GARNIER. On excavation of the optic disc. *Wjest. Ophtal.*, 1894, No. 3.

In every eye there is a funnel-shaped excavation of the disc which when physiological never reaches the lamina cribrosa, and is only visible with the ophthalmoscope when the point at the bottom of the excavation, where the vessels divide, is covered with a strongly reflecting spider-web-like membrane of fœtal origin. In 2594 eyes GARNIER (549) found a visible excavation in 26 %, which he separates into those occupying the middle of the lateral half of the disc, those crossing the median line somewhat, and those occupying nearly the entire disc. Fourteen % were of the first category, 11 % of the second, and 1 % of the third. Unilateral excavation in 1 %. A conus was present in both eyes in 35 %, in one in 26 %, conus upward in ¼ %, and downward in 2 %. In 24 % of cases of conus there was excavation. Staphyloma was found in 6 %, 7 staphylomata to 100 coni. The ratio of excavation to refractive conditions was M. 40; H. 26; E. 24. The greatest excavations were found in myopia.

HIRSCHMANN.

XX.—INJURIES (FOREIGN BODIES, PARASITES).

550. HAAB. On the employment of very large magnets in cases of injury of the eye by splinters of iron. *Correspondenzbl. f. Schweizer Aerzte*, No. 1, 1894.

551. SCHIRMER. Minor ophthalmological contributions. 1. Is the extraocular employment of magnets without danger? *Deutsche med. Wochenschr.*, 1894.

552. DEUTSCHMANN. Extraction of a splinter of iron from the vitreous by means of a strong magnet. *Beiträge zur Augenheilk.*, xiii., 1894.

553. TOPOLANSKI. Presentation of patients. 1. Splinter of steel in the eye for twenty-three years. 2. Operation of high myopia. *Wiener klin. Wochenschr.*, 1894, No. 11, p. 200.

554. HIRSCHBERG. Copper in the eye. *Deutsche med. Wochenschr.*, No. 14, p. 313, 1894.

555. BOYLE. Shot-wound of the left eye with loss of sight in the right. *Journ. of Ophth., Otol., and Laryngol.*, Jan., 1894.

HAAB (550) states that the results of magnet operations are not what it was hoped they would be. The most favorable results are obtained when large magnets are used. Care must be taken to have the attracting force of the magnet act in the direc-

tion of the entrance wound, and the operation should be done early.

SCHIRMER (551) saw an acute attack of glaucoma follow the attempt to remove a foreign body located in the fundus.

HIRSCHBERG (554) reports 16 cases of injury of the eyes with copper. Copper may be easily removed from the conjunctiva, cornea, or iris; it may remain without danger in the lens; in the vitreous it usually causes suppuration, and the eye is lost. In the fundus it usually causes suppuration, or more rarely the formation of new connective tissue, which shrinks and detaches the retina.

In BOYLE'S (555) case a pistol-ball passed through the left eye and the orbital wall a quarter of an inch to the right of the optic foramen, and then through the sphenoid, fracturing the clinoid process, after which it passed beneath the right optic nerve through the middle and posterior lobes of the brain, and was found lying on the inner surface of the right parietal bone. In life there was complete blindness in the right eye and a slight neuro-retinitis.

XXI.—OCULAR DISTURBANCES IN GENERAL AFFECTIONS.

556. LANDMANN. Monocular polyopia. *Annals of Ophth. and Otol.*, Jan., 1894.

557. DODD, O. Conjugate deviation of the eyes with suppuration of the middle ear. *Jour. Amer. Med. Asso.*, Feb. 10, 1894.

558. MAGNUS. A case of cortical blindness. *Deutsche med. Wochenschr.*, No. 4, 1894.

559. PONTOPPIDAN. On hemianopia. *Hospitalstidende*, No. 15, Copenhagen, 1894.

560. BONDY. On nitro-benzol poisoning. *Prager med Wochenschr*, 1894, No. 11.

561. GROCZ. Changes in the fundus in consequence of stenosis of the aorta and its branches. *Pest. med.-chir. Presse*, 1894, No. 9.

562. GRUBE. On the etiology of Basedow's disease. *Neurol. Centralbl.*, p. 179, 1894.

563. HETZEL. A contribution to the pathological anatomy of Basedow's disease. *Deutsche Zeitschr. f. Nervenheilk.*, vol. iv., p. 353.

564. UHTHOFF. Investigations on the ocular disturbances following syphilis of the central nervous system. 2d part, 2d half. *Graefe's Archiv.*, xli., p. 43.

565. BULL, C. STEDMAN. Gouty retinitis, chorio-retinitis and neuro-retinitis. *Trans. Amer. Ophth. Soc.*, 1893.

566. NATHANSON. On the symptomatology and pathological anatomy of anæmia perniciosa helminthiaca. Reprint from *Jeschenedelink*, No. 6, 1894.

567. SULZER. The ocular symptoms of paralyzing vertigo. *Ann. d'ocul.*, cxi., p. 5.

568. BRUNS. A case of alexia with right homonymous hemianopsia; autopsy. *Neurol. Centralbl.*, 1894, pp. 8 and 50.

569. MAHAIM. A case of secondary affection of the optic thalamus and the subthalamic region. *Arch. f. Psychiatrie u. Nervenkrankheiten*, xxv., p. 243.

570. KOSTENITSCH. On a case of motor aphasia; a contribution to the subject of the anatomical basis of iridoplegia. *Deutsche Zeitschr. f. Nervenheilk.*, 4, p. 369.

571. ROTHMANN. The diagnostic value of hemianopic pupillary reaction. *Deutsche med. Wochenschr.*, 1894, No. 15. p. 336.

572. RANDOLPH, R. L. A clinical study of 40 cases of epidemic cerebro-spinal meningitis. *The Johns Hopkins Hospital Bulletin*, June–July, 1893.

573. DERBY, R. H. Affections of the eye apparently dependent upon uterine derangement. *N. Y. Eye and Ear Infirmary Report*, Jan., 1894.

LANDMANN (556) gives the clinical history of two cases of monocular polyopia of traumatic origin. In both cases there was strabismus, due in one case to paralysis. In the case of a child of eleven there was diplopia, in that of a man of twenty-eight polyopia with five images at first, which in the course of a month were reduced one by one to a single image. BURNETT.

DODD's (557) case was that of a man of eighteen who had suffered since infancy with left otorrhœa. At the time of observation he had giddiness, vomiting, increased temperature, and sensitiveness of the mastoid above and behind the meatus. A polypus was removed. The eyes could be turned to the right with difficulty. No diplopia; slight facial paresis. The inability to move the eyes increased for some days and then decreased,

ceasing altogether in two or three weeks as the otorrhœa was checked. BURNETT.

MAGNUS (558) reports a case of recent right homonymous hemianopia in a patient who had had a left homonymous hemianopia for 13 years previously. Here, as in the cases of Foerster, Schweigger, etc., a small central field was preserved. Eleven weeks after the attack the vision had increased to R $\frac{1}{2}$, L $\frac{1}{24}$. The noticeable feature in the case was the patient's difficulty in orientation. There was no paralysis, and pupillary reaction was normal, so that the seat of the affection was located in the cortex.

Hemianopia is frequent with local affections of the brain, but very rare with diffuse ones. PONTOPPIDAN (559) believes, however, that hemianopia may be a symptom of superficial brain affections with cortical paralyses, and cites a number of cases. He also cites several cases of bilateral hemianopia, and a case of heteronymous hemianopia in which the line of demarcation passed exactly through the fixation point.

In a case of nitro-benzol poisoning, seen in Prof. v. Jaksch's clinic, BONDY (560) found the ocular media clear, the retina pale, the veins and arteries of a uniform dark color.

HERRNHEISER.

GRUBE (562) believes Basedow's disease to be due to an intoxication. His patient, who had suffered with the disease for six weeks, had 9 % of sugar. The swelling of the lymphatics and the hereditary nature of the trouble support his view.

UHTHOFF (564) describes the disturbances of motility and sensation in the eyes of 100 individuals with cerebral syphilis. There were 34 cases of oculo-motor disturbance, 15 of abducens, 5 of trochlearis, and 14 of trigeminus, which appeared for the most part from 1 to 2 years after the disease was acquired. The bilateral oculo-motor paralyses found in 15 % of all cases were usually due to a basal syphilitic process, which at the same time affected other nerves. Hemiplegia, paraplegia, and homonymous and temporal hemiopia were often found. At times, however, there were cases of bilateral paralysis without other basal complications. The unilateral oculo-motor affections without crossed hemiplegia were in 78 % of cases due to basal syphilitic disease. The optic nerve, abducens, and trochlearis were affected in several cases. Unilateral oculo-motor paralysis with crossed hemiplegia was seen 4 times. In most cases the lesion was a gummous neoplasm in the region of the peduncle, thus explaining the rarity of the involvement of the optic nerve.

The isolated ptosis often mentioned is considered nuclear or fascicular, and not cortical in origin. It may be produced by a purely basal cause, and in this case may be partial. Abducens paralysis is more frequently bilateral than unilateral, and is probably mostly of basal origin. Trochlearis paralysis was never found alone, the oculo-motor being always affected also, so that the condition was often that of ophthalmoplegia externa and interna.

Basal foci were always present.

The trigeminus was affected in fourteen cases, always unilaterally but together with other nerves. The optic nerve was involved eleven times, and with it the facial was affected in half the cases. Neuroparalytic keratitis was seen once. The trigeminus affection was always basal. Nystagmus was found twice, and conjugate deviation once. Reported cases show that the eyes look toward the lesion when it is located in the cerebrum, and away from it when it is located in the mesencephalon, pons, or corpora quadrigemina. Reflex iridoplegia with preserved convergence reaction was found ten times, and total iridoplegia four times (in tabes 60–90 %, in paralysis 50 %). In sclerosis, alcoholism, senile dementia, head injuries, etc., it is much rarer. Hemiopic pupillary reaction was seen once, and hippus once. Isolated disease of the optic nerve or of the optic conducting apparatus was noted twenty times. Bilateral inflammation was the most frequent, with hemiopia next. Not infrequently the optic nerve is alone affected. Only in 15 % of cases of cerebral syphilis are ocular symptoms wanting. The combination of marked tabic symptoms with the changes due to cerebral syphilis was rare.

Bull (565) gives detailed clinical histories of five cases, and the results of the microscopic examination of two in which there were changes in the retina and choroid, chiefly vascular, in persons who were gouty. His conclusions are as follows: The fundus changes are always bilateral, though rarely symmetrical in the two eyes. 2. The degeneration in the walls of the vessels affects central vision considerably, peripheric vision slightly if at all, and never leads to blindness. 3. The decrease in central vision is to a certain point progressive, if the nature of the process is not recognized early, and properly treated. After the affection is developed, improvement in vision cannot be expected. 4. Retinal hemorrhage is rare, except in the beginning, due probably to the fact that the resistance of the vessel's walls is increased by the deposits, although its elasticity is diminished. 5. The chief

fundus symptom is the development of sclerosis in the arteries and veins. This may be seen with the ophthalmoscope in the retinal vessels, and the microscope shows the same changes in the vessels of the choroid and optic nerve. 6. Another pathognomonic symptom is a peculiar yellow granular exudation about the posterior pole of the eye, usually leaving the macula intact. With the microscope this is found to be chiefly in the nerve-fibre layer, although it is present in all the layers excepting the rods and cones. 7. The changes in the optic-nerve fibres seem to be entirely intraocular. BURNETT.

NATHANSON (566) considers retinal hemorrhage a diagnostic sign of pernicious anæmia, whether essential or helminthic. The characteristic features of these hemorrhages are their location in the neighborhood of the disc, their small size, and their oval form. The middle of the spot is at times of lighter hue, and they disappear completely in two or three weeks. Anatomical examinations showed that the extravasations, consisting of red blood corpuscles, lay partly upon the anterior surface of the retina, or between the superficial layers, and partly invaded the retinal tissue or were deposited about the vessels. The posterior layers of the retina were free from extravasation. Choroid and sclera showed nothing pathological. The intima and media of the vessels were unchanged, the adventitial spaces dilated and filled with blood corpuscles. No ruptures of the vessels could be made out. The retinal tissue was slightly œdematous. The extravasations are produced by diapedesis, and coincide with the appearance of poikilocytes and microcytes. The author believes, therefore, that the ophthalmoscopic examination may replace the tedious examination of the blood for verifying the diagnosis of pernicious anæmia. The cases observed by the author lead him to believe that the pernicious anæmia is caused by the toxic action of dead, macerated tape-worms, these not giving rise to toxic symptoms while alive. HIRSCHMANN.

SULZER (567) speaks of a disease which is as interesting as it is little known. Gerlier and a number of others have in the past ten years observed a previously unknown form of disease in Pays de Gex and in the Swiss cantons Geneva, Vaux, and Freiburg. The patient suddenly feels a severe pain in the neck radiating to the back. The vision becomes indistinct and there is diplopia. The eyelids droop and the muscles of the trunk and limbs relax. The attack lasts ten minutes, but in the intervals the patient i

too weak to perform his ordinary work. There is often a permanent incomplete ptosis, and central vision is reduced. In the cases examined by Sulzer there was ptosis, imperfect sight, irregular contraction of the field of vision, partial pallor of the optic discs, and venous hyperæmia of the retina. SULZER.

BRUNS's (568) case was a woman of thirty-two, who presented speech disturbances and right homonymous hemianopia with choked disc. A diagnosis of tumor in the occipital lobe was made and a tumor removed by trephining, after which the choked disc grew better. A month later the patient died, and three angio-sarcomata were found, the largest being in the left occipital lobe.

MAHAIM (569) found that from an old cerebral focus there was a descending degeneration of the cortical corpora-quadrigemina fibres and their ganglion cells in the nuclei of the thalamus opticus and the ophthalmic region.

KOSTENITSCH (570) found changes in a case of aphasia with reflex iridoplegia—a diffuse round-celled infiltration of the central gray matter. The ganglion cells of the oculo-motor nucleus were normal. Only in the lower group of the Westphal-Edinger nucleus were there slight changes, consisting in shrinking and atrophy of the nerve cells.

ROTHMANN (571) reports a case of transient hemiopic pupillary reaction. He believes the following conclusions justifiable. If hemiopic pupillary reaction is found with hemiopia which has appeared suddenly, and if it persists, the process is a basilar one in the region of the optic tract. If the hemiopic pupillary reaction is transient, it is merely the effect of action from a distance. The lesion lies behind the origin of the reflex fibres. If hemiopic pupillary reaction is wanting altogether with hemiopia, the lesion is located outside of the reflex arc, but whether in the cortex or in the internal capsule cannot be said. The appearance of hemiopic pupillary reaction after hemiopia has existed for a time indicates secondary degeneration of the fibres of the tract. Hemiopic pupillary reaction without hemiopia indicates a lesion between the corpora quadrigemina and the sphincter iridis.

The most striking feature found by RANDOLPH (572) in his 40 cases of cerebro-spinal meningitis was a remarkable tortuosity and distension of the retinal veins, the blood appearing almost black as if stagnant, and corresponded closely to the con-

dition of the vessels of the brain, as they were found *post mortem.* Vision was not impaired except in 3 of 36 cases examined in that particular. BURNETT.

DERBY (573) relates four cases of changes at the fundus—neuroretinitis with hemorrhages in two instances—which seemed to have a connection with the menstrual function.

BURNETT.

MISCELLANEOUS NOTES.

BOOK NOTICES.

Traité des Maladies des Yeux. By PH. PANAS. Two large octavo volumes, of 1286 pages, with 296 figures in the text and 7 colored plates. G. Masson, Paris, 1894.

Though the text-book of ophthalmology, written by the official representative of ophthalmology in the medical faculty of the University of Paris, has been very appreciatively reviewed by Dr. Sulzer, lecturer on ophthalmology at the University of Geneva, and in the text of our systematic report on the progress of ophthalmology (p. 475 this vol.), the importance of the work of the eminent ophthalmic surgeon, clinician, and investigator, to whom the writer, like a thousand others, is indebted for most valuable personal instruction, is so great that we cannot refrain from giving it a hearty welcome also in our special department of Book Notices. The beautifully gotten-up work keeps the mean between a student's compendium and a reference cyclopedia, being a book for the oculist who is familiar with the facts of his profession. He will hail with the greatest satisfaction the appearance of an elaborate treatise by one of the recognized authorities in his special department, who offers him, in admirable form, the results of his personal experience and of his general and literary knowledge.

The work begins with a good description (51 pages) of the *anatomy* of the eye, largely based on studies made in the laboratory of the author. The figures are, as in the whole work, exceedingly clear and demonstrative. We may point out, as an example, those of the ciliary region, Figs. 12–17.

The second chapter treats of the *nutrition* and the *intrinsic motility* and *sensibility* of the eye, tracing the course of the fibres

of the optic nerves in the brain. Chapter III. gives a sketch of the development of the eye (11 pages), clear and sufficient for the ophthalmic practitioner.

The next part, *physiological optics*, treats not only of the normal accommodation and refraction, but also of its anomalies, the methods of examination, ophthalmoscopy, skiascopy (which the author calls skioposcopy), and ophthalmometry ; furthermore, of color perception and its errors, of the visual field, etc. The determination of the range of convergence gives the method of expressing this range in the meter-angle of Nagel, which it is good to know, but consumes too much time to be used in practice. It is sufficient to determine and note the muscular forces and their deficiencies in degrees of prisms. The insufficiencies do not receive the attention they deserve ; in a few lines only (p. 216) the disturbances of equilibrium and the resulting asthenopic nervous symptoms are described, especially the vertical insufficiency —the hyperphoria of Stevens.

The *pathology* of the eye begins with the diseases of the cornea, which are presented very fully. Very little is omitted ; for instance, that rare but marked form of progressive necrosis, which passes in concentric circles partially or totally over the whole cornea, known under the name of ulcus rodens of Mooren, is not mentioned as far as we can see. The different forms of keratitis recently drawn into notice, for instance the filamentous keratitis, are well described. Chapters II.–V., 205 pages, contain the diseases of the uveal tract, sclerotic, vitreous, and glaucoma. The descriptions are very detailed, clear, and interesting, with extensive use of the incident literature. Chapter VI., cataracts, 90 pages, is masterly, as might be expected, for in the operations for cataract Panas is unexcelled, as everybody knows who has had the advantage of witnessing his work in the Hôtel Dieu. For him extraction is the general method for all cataracts, the secondary as well as the primary, only in uncomplicated capsular obstructions of the pupil after extraction, division with a single needle should be made. He does not advocate any of the ripening methods, except simple iridectomy. Incomplete cataracts should only be removed on the solicitation of the patient, for in them the final success is much less assured than in fully ripe cataracts. Confounding totally sclerosed lenses (which retain a good deal of transparency) with immature cataracts, some operators have overstated the rate of success obtained in opera-

tions on the latter. Chapter VII., 131 pages, the last of the first volume, contains a good presentation of the diseases of the retina and optic nerve, which everybody will read with pleasure and profit.

The second volume is smaller than the first, having 514 pages against 772. It begins with the anatomy and physiology of the ocular muscles, and describes the different kinds of strabismus, ocular palsy, and other nervous affections.

The eyelids receive considerable attention. In the blepharoplastic methods, the author reproduces a number of old operations from which the reviewer has seen no permanently good results, whereas the French method of stretching lateral flaps (*méthode par glissement*), with which the reviewer and others have had permanently good results, is omitted. It is true that the varieties of blepharoplasty are legion, to which even an extensive monograph could scarcely do justice.

The diseases of the conjunctiva, which receive 108 pages, will interest the critical reader very much, though he may differ from the author in many a point; for instance, in the classification blennorrhœa, croup, and diphtheria rank as subdivisions of purulent conjunctivitis, which is bacteriologically inadmissible, though diphtheria commonly has a purulent afterstage. Conjunctivitis follicularis is considered essentially different from conjunctivitis granulosa (trachoma), "which enters into the class of suppurative processes." Racial differences are "contestable," should read "incontestable," as S. M. Burnett and other American authors have demonstrated. The remaining chapters—lachrymal apparatus, orbit, and cranio-facial sinuses—are all excellent. The author's broad medical education and his extended experience as a general surgeon manifest themselves in the skill and the great degree of originality with which he handles these diseases. The inflammations of the sinuses are called "sinusites," a word which is met with in recent French literature, but has not yet, so far as we know, received citizenship in other countries.

Taken all in all, the work is a great success. It is fascinating reading by the clearness, simplicity, and elegance of its style, the vast information it imparts, the points for further investigation it suggests. It was certainly a great and bold undertaking for one man to write a complete text-book on ophthalmology at the present day, for much as we admire each chapter for its intrinsic value and its fit dimension to be an harmonious part of the whole, there is not

one of these chapters which, besides the satisfaction it gives, does not awaken the desire to have more of it and go further and deeper. To satisfy this desire we have to go beyond text-books to monographs, cyclopædias, the discussions of societies, the original contributions in the periodical press. No student or practitioner however, be he a beginner or an expert, should ignore good, modern text-books, like the one under consideration, for they will make him acquainted methodically, and with the least consumption of time, with the development and recent status of the science and art of his profession.

APPOINTMENT.

Prof. LUDWIG MAUTHNER has been appointed to succeed Prof. STELLWAG VON CARION, as Professor of Ophthalmology in the Medical Faculty of the University and Director of the Ophthalmic Clinic of the General Hospital in Vienna.

Obituary.

On September 8, 1894, Prof. HERMANN VON HELMHOLTZ died at Charlottenburg, near Berlin, at the age of seventy-three years. It is not for us to set forth his unexcelled merits as a scientist—Tyndall, in one of his popular lectures, held in New York, called him a spirit akin to Newton—but as oculists we all know what an immense debt of gratitude we owe him. He was the founder of modern ophthalmology. In 1851, when quite a young man, he invented the ophthalmoscope, an instrument which soon revolutionized eye surgery, and gave the idea for other not much less precious means of diagnosis, all of which are now in the hands of every physician. In 1855 appeared (*Graefe's Arch.*, vol. i., part 2) his celebrated article "On the Accommodation of the Eye," in which, preceded by Thomas Young and Cramer, he demonstrated the internal mechanism of the eye by the methods of the exact sciences. One of the instruments—the ophthalmometer—which he used in this model investigation has, through a happy modification by Javal and Schiötz, of Paris, been transferred from the laboratory of the scientist to the consulting-room of the ophthalmic practitioner. In 1855 Helmholtz began his researches on physiological optics and acoustics. The results of eleven years of continuous labor are embodied in two fundamental and classical works, the *Handbook of Physiological Optics* and *Die Lehre von den Tonempfindungen* (Doctrine of Tone Sensations). The wealth of original research, the accuracy of the methods, the sublime precision and elegance of the demonstration which distinguish these two works, and, above all, the innumerable practical results which flow from them, will for ages to come instruct the student, guide the expert, and inspire the investigator. It was one of the characteristic features of Helmholtz that he never broached a

barren question; before he commenced working he carefully considered whether a solution was possible and whether the result would be of scientific and practical value. In 1871 Helmholtz left the chair of Physiology at the University of Heidelberg to follow a call as Professor of Physics to the University of Berlin. During the last years of his life he occupied the position of Director of the Imperial Physico-Technical Institute. His work during this time, in the highest sphere of physico-mathematical science, has been the admiration of the best minds of the world.

Besides his scientific work his future biographer will have to consider his official position. He was a university teacher from the beginning to the end of his career, and he appreciated and cherished this occupation more than is commonly known. He said, teaching, even for an explorer, is no loss of time. It keeps him in touch with the rising generation, prevents him, by constant rehearsing of the stock of knowledge acquired by the labor of past ages, from becoming one-sided and narrow, and furnishes him with practical, living questions for research. He was punctual in the discharge of his official duties, never missed a lecture, never was late. He had an unlimited capacity for prolonged labor, and used it in such a methodical way that he never appeared tired. The allotment of his time for waking and sleeping, work and recreation, home life and travel, was such as to make his labor in the highest degree efficient, and his life not only most useful but also most enjoyable and healthy. He hated to be annoyed by idlers and scientific pretenders, but he was most willing and delighted to explain to his pupils and intelligent laymen and women the most occult phenomena of nature. In the lecture room he always was precise and unswervingly adherent to the subject, never "being out of order," despising jokes and stories to amuse his audience. In his popular lectures, which all were admirable, he kept the attention of his listeners by the wealth of interesting facts and the clearness, precision, and elegance of his delivery. In the laboratory he daily devoted hours in directing and supervising the experiments of the young savants, helping one in arranging and simplifying his apparatus, extricating another from mathematical entanglement, revising for a third his manuscript before it was published. A great part of his scientific work thus was given to the world under the names of his pupils. He could well afford it, he was so rich. He never claimed priority, but was most conscientious in acknowledging the merits of others. He

constantly was in contact with his pupils, they became his friends. At Heidelberg on Saturday afternoons, when the work of the week was over, he made excursions with his laboratory students into the vicinity of that beautiful town, and then dined with them in the evening. Though he abhorred vulgarity there was nothing stilted and heavy about him.

He was married twice. Of his first wife Prof. Donders said, that she was the most amiable lady he ever met. His second wife, the daughter of the celebrated professor of law and statesman, Robert v. Mohl, survives him. By her intelligence, grace, and adoring love she was for him the most genial companion.

Taking him all in all he was as nearly a perfect man as nature has ever produced; the gift of the highest intellect combined with nobility of character and purity of life.

H. K.

EDITORIAL NOTICE.

The great supply of original contributions has made it impossible to furnish in either edition of these ARCHIVES translations of every article appearing in the other. In order to do justice to the authors and inform our readers promptly of all the contents of both editions, we shall in future print by title the papers of the one edition in the next issue of the other, give abstracts of all of them in our systematic reports on the progress of ophthalmology, and translate in full or more or less condensed as many as our space will permit. Reprints of all the original articles of the German edition may be had, for reference, on application to Dr. H. Knapp, 26 West 40th Street, New York, and reprints of the English edition on application to Mr. J. F. Bergmann, 20 Schwalbacher Strasse, Wiesbaden, Germany.

H. KNAPP.
C. SCHWEIGGER.

NEW YORK, Oct. 1, 1894.

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A.—ORIGINAL ARTICLES:

1. The Theories of Strabismus. By Prof. EDMUND HANSEN GRUT, Copenhagen.

2. Contributions to the Question of the Physiology and Pathology of the Corneal Refraction. (Preliminary communication.) By Dr. ADOLF STEIGER, Zurich.

3. A Word with Reference to the Pathology of the Optic Nerve. By Prof. E. ADAMÜK, Kasan. (With six illustrations in the text.)

4. Upon the Localization of Fragments of Iron in the Eyeball by the Aid of the Magnetic Needle. By Dr. EDUARD ASMUS, Assistant Physician to the Royal University Ophthalmic Clinic in Breslau. (With one illustration in the text.)

5. Contribution to the Question of the Operative Treatment of Myopia of High Degree. By Dr. M. HORI, Physician of the Imperial Staff, Tokio.

6. Bilateral Distortion of the Outer Commissure of the Lids Due to Congenital Contracture of the Platysma. By Dr. RUDOLF DENIG, Assistant at the University Ophthalmic Clinic, Würzburg.

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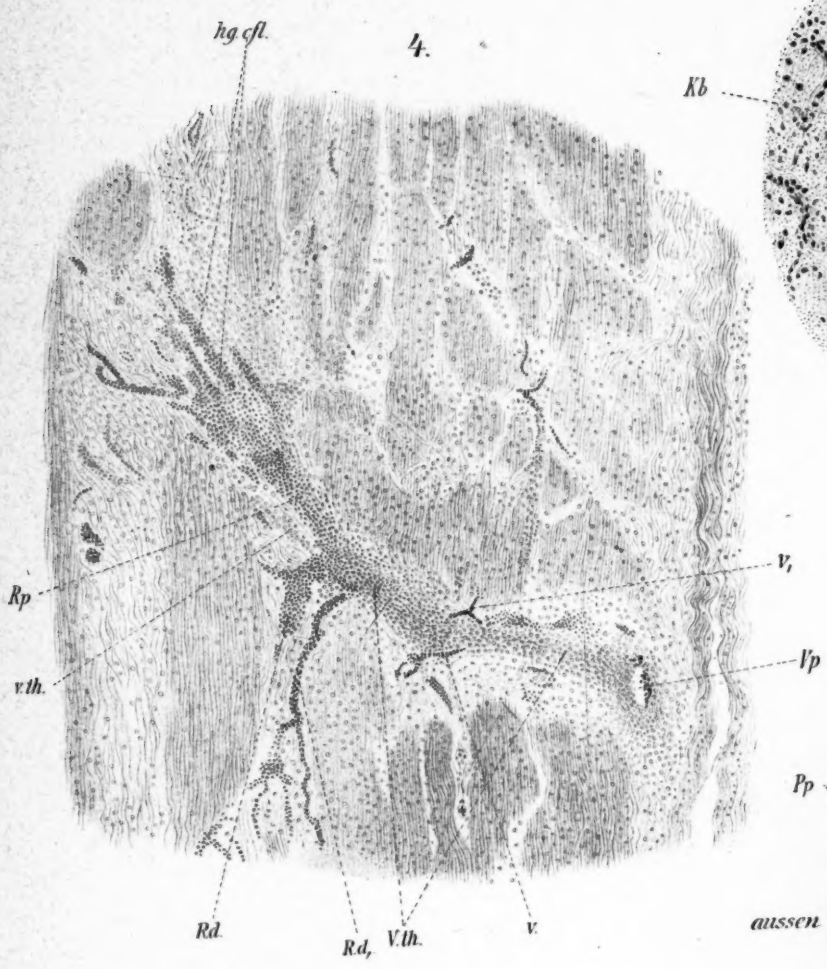

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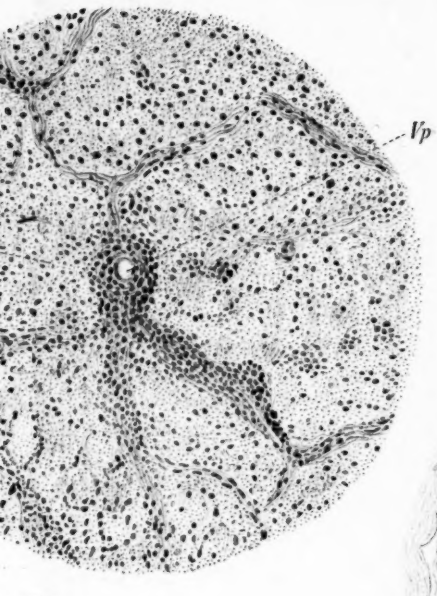

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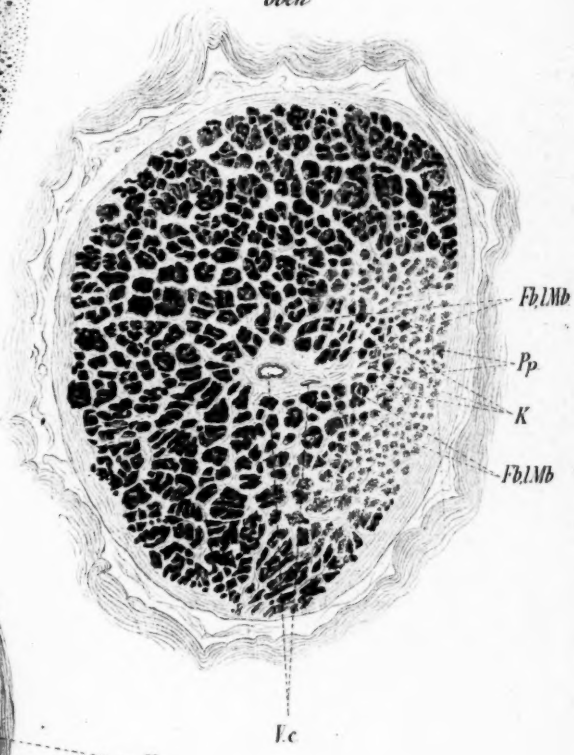

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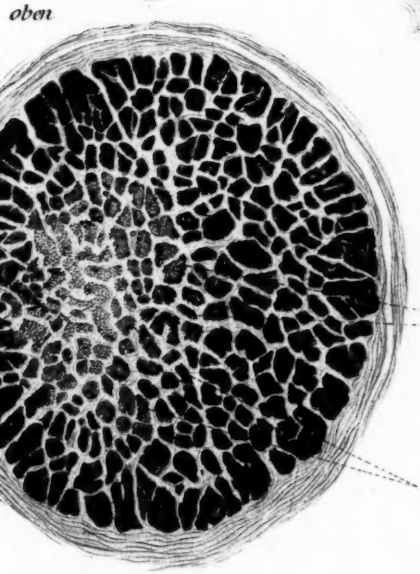

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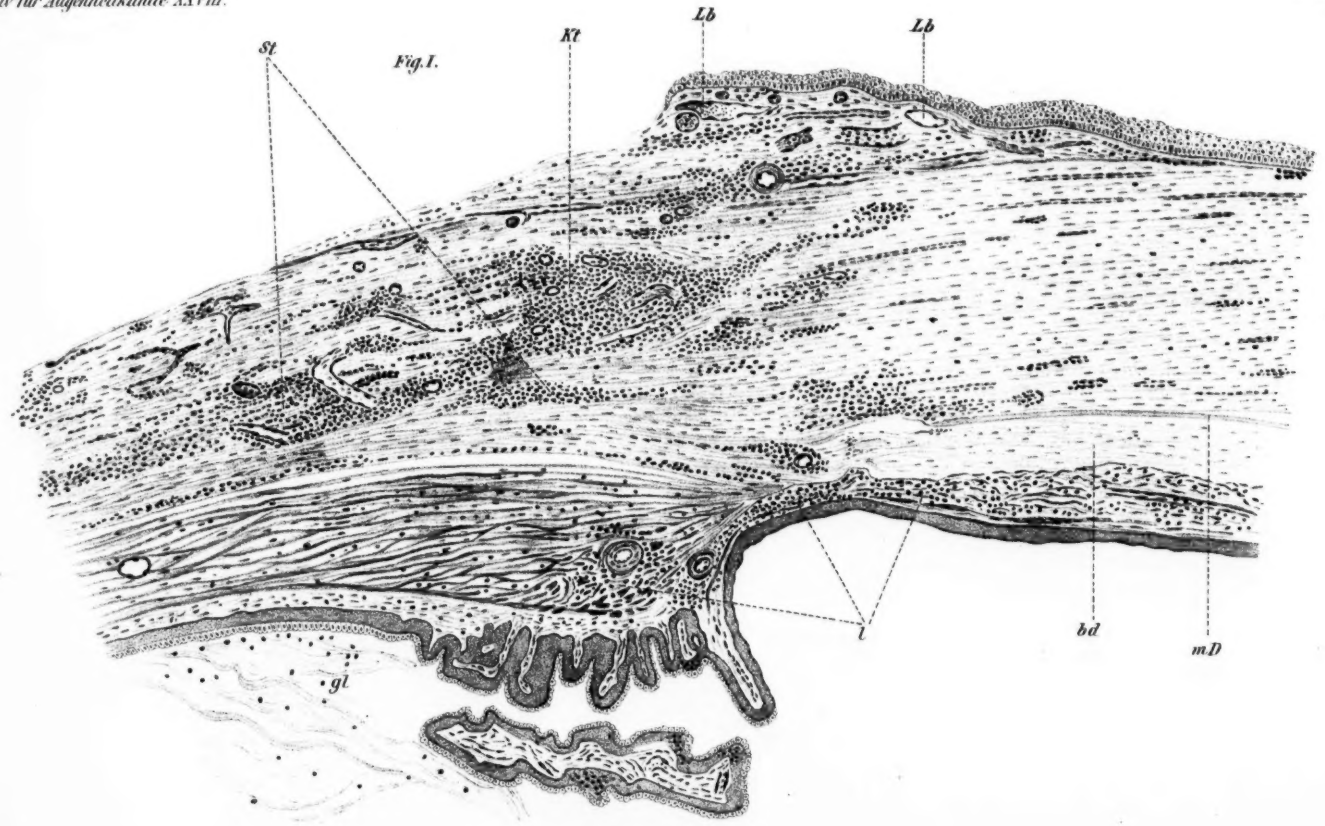

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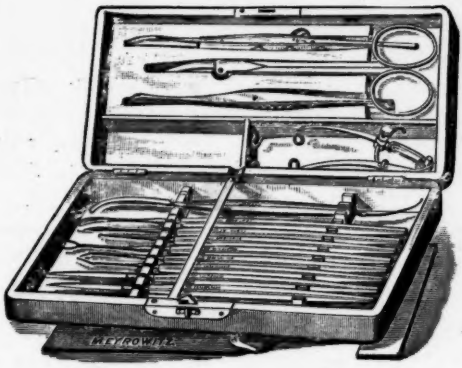

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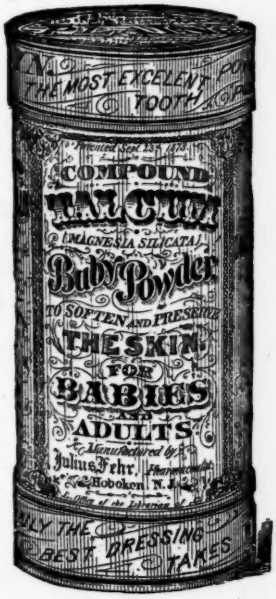

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